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Man and Environment

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Indian Society for Prehistoric and Quaternary Studies

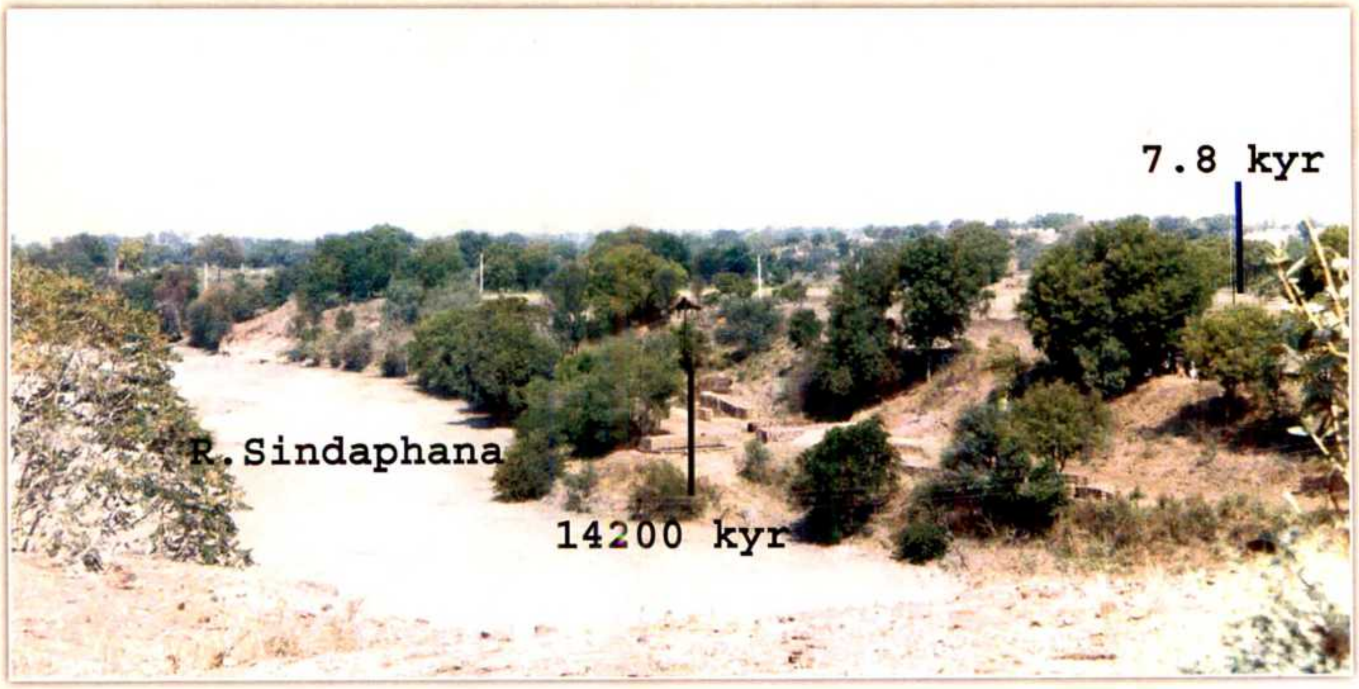

Fig. 4: Alluvial section exposed on the left bank of the river Sindaphana

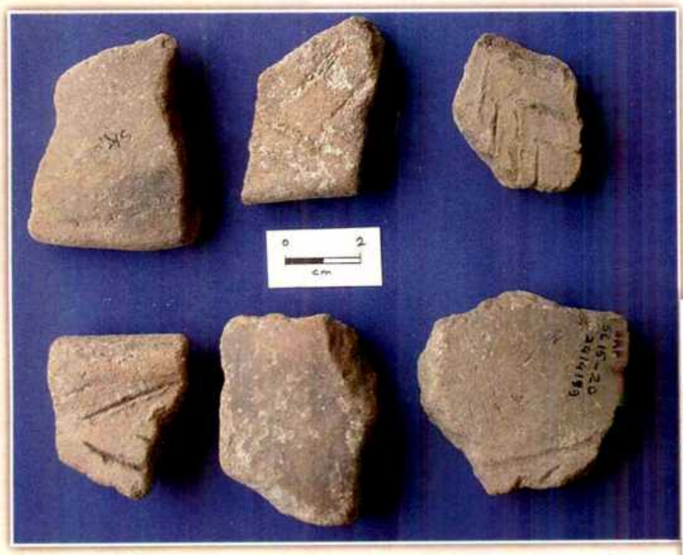

Fig. 7: Decorated sherds — Sakshal Pimpri

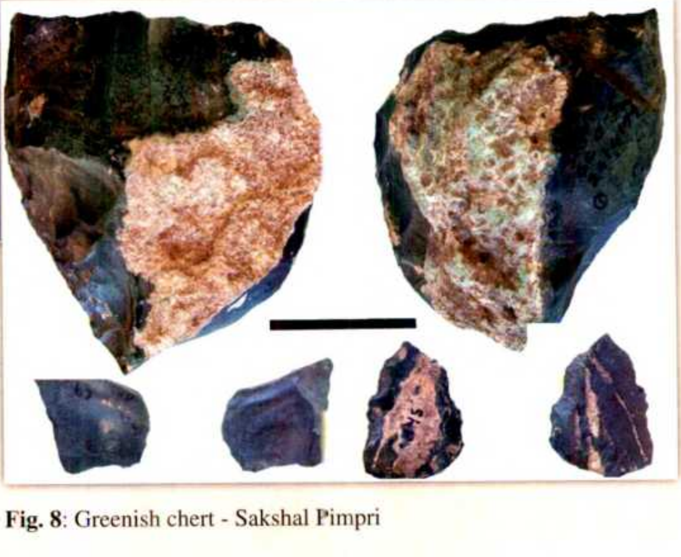

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Fig. 8: Greenish chert - Sakshal Pimpri

Sheila Mishra *et al.*, *Man and Environment* XXXI(1): 19-26 [2006].
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Man and Environment

Journal of the Indian Society for Prehistoric and Quaternary Studies

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Editorial

During the XXXII Annual Conference of the Indian Society for Prehistoric and Quaternary Studies held at Bangalore in December, 2005, two scholars, L.Anjana Reddy from Chennai and Sharada Srinivasan from Bangalore, successfully competed for the Malti Nagar Ethnoarchaeology Award on the basis of their research presentations. Anjana Reddy's presentation, based on her ethnographic study of the Chenchu settlement systems in Nallamalai Hills, Andhra Pradesh, attempted to develop a model for studying prehistoric settlement patterns. . Her paper is appearing in this issue of *Man and Environment.* Sharada Srinivasan studied megalithic high-tin bronzes from ethnoarchaeological and archaeometallurgical perspectives. Her paper will appear in the December issue of the journal.

Sheila Mishra and her colleagues describe archaeological finds at the sixth millennium B.C site of Sakshal Pimpri, District Bid, Maharashtra. R.K. Mohanty and M.L. Smith provide a brief account of their excavation, conducted in 2005, in the walled Early Historic city of Sisupalgarh in Orissa. A.S. Gaur and others report the results of an onshore excavation at Bokhira (Porbandar) on the Saurashtra coast. C.B. Patil of the Archaeological Survey of India reviews various issues related to the history of human occupation in coastal Karnataka.

V.N. Misra presents a gazetteer of archaeological sites in Rajasthan spanning the period from the Early Palaeolithic to the Early Historic.

Keshava and Sujatha Kumbhar, specializing in library science at the Karnataka University, Dharwad, an Trupti More, librarian of the Deccan College, Pune, present papers of a different nature. Keshava and Sujatha Kumbhar's paper deals with a bibliometric study of the various dimensions of the articles published in *Man and Environment* between 1995 and 2004. Trupti . More has prepared an index of articles published in volumes XXI-XXX of *Man and Environment.*

Short communications include a summary of excavations at Agar, near Junnar in Pune district by Shreekant Jadhav); a report of the accidental discovery of a cave at Kodakkal in Kerala by Ajit Kumar; and two articles by N. Kazanas on Rigvedic *pur* and the river Saraswati. There has been a lot of interest in, and debate on the question of the existence of cities in the Rigvedic period and on the role of the Sarawati river in the rise and fall of the Harappan civilization. Several books and many papers have been published on these subjects. Kazana's papers are a part of that going debate. We would happy to hear our readers comments on these papers.

We hope that our readers will find the contributions in this issue both informative and readable.

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The Society publishes its bi-annual Journal (June and December) *Man and Environment*. This journal publishes recent and *original* research in the field of South Asian archaeology, including related topics in environmental, anthropological and historical disciplines. The journal has five types of contributions: research articles, short notes, review articles, obituaries, and seminar and conference news. Books are welcome for reviews. The editors will send the book to suitable scholars to be reviewed. All articles submitted for publication are sent to referees. Authors will be asked to revise their manuscripts in the light of these comments. Acceptance of the manuscript will mainly depend on the opinion of the referees. This volume has the latest guidelines.

Contributors should send two sets of the manuscript (including figures and tables) along with an electronic copy of the paper in Microsoft Word on a 3.5" floppy diskette or CD. Please mark the diskette with your name, and the name of the software programmes you have used for the manuscript and the figures. The manuscript and electronic copies should be addressed to Prof. V.N. Misra, G-2, B Wing, Ganga Park, Mundhwa Road, Pune 411 036 or Dr. P.P. Joglekar, c/o Department of Archaeology, Deccan College, Pune 411 006, India.

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Cover: Artefacts recovered from Kodakkal

Chenchus are usually located by the side of a perennial stream or lake.

Location of Settlements

Base camps are located on the following terrain types; *Banda* (rocky terrain), *Bailu* (plateau and plains), *Mydanam* (interior forests on plain ground) and *Chama (valley)*. The elevation of the terrain is as follows:

1. 1% occur at an elevation of 900 m (highest peak Durgam Konda at 917 m)
2. 10% occur at an elevation 700-800 m
3. 13% occur at an elevation of 300-500 m
4. 76% occur at an elevation below 200 m (Thulasi Rao 2000).

Ethnographic data recorded in this study indicates that settlements established on the 700-300 m elevation (23% of the total area) are within the *Banda* (hilly/rocky) terrain; while Chenchu settlements below 200 m (76% of the total area) are *Bailu* consisting of plateaus, plains and valleys.

Temporary dwelling sites or work camps are situated closer to the site catchment area and consist of 1 or 2 low grass huts each occupied by one family. These settlements are located in the forest a few kilometres away from the base camp or in some cases at a considerable distance away owing to the depletion of the resources located nearby. The Chenchus settle here for a period of 3-4 months. These sites are occupied seasonally during summer, especially during April and May. Activities include digging for tubers, medicinal plants, plant food and small game hunting. Grass huts are periodically abandoned and re-occupied during the monsoon (July to September).

The third type of settlement consists of transient camps which are mostly open-air sites (rock shelters and beneath trees). They are common on tablelands of the western peninsular plains (300-500 m) and on the limestone plateau and cave areas of Kurnool where there is no major water shed (Murthy 1985). Located close to seasonal springs and lakes these encampments are situated within the catchment area itself. They consist of 2-3 families from the same clan or kin group. Activities include sharing and distribution of game and plant food procured from the catchment, as also cooking of a portion of the catch. The rest is carried back to the Chenchu base camp where the final processing and cooking is done. Activities performed here leave minimum material remains owing to the short duration of the camp. Given the nature of the smooth flat rock terrain especially at rock shelter sites in the Nallamalais, material remains are dispersed and washed away during the rains.

Settlement Pattern Case Studies

Chenchu settlements in the Nallamalais are spread across a wide region. These settlements are sporadic clusters that spring up due to various factors. It is very difficult to determine the circumstances that Chenchus look into before choosing a site for their settlement. Archaeological scatters in the Srisailam plateau and the Nallamalais occur mostly on flat rock surfaces (similar to the *Banda* terrain occupied by the Chenchus); but their concentration is found near perennial water sources. In the case of the Chenchus, it is the proximity to the forest and forest resources that appears to be an essential factor as compared to the proximity of water sources, especially as related to the establishment of permanent settlements. Haimendorf (1943) mentions that settlements are never built close to the water for fear of wild animals that come to drink, but in a clearing some distance away. The author recorded that in some forest settlements, Chenchus travel up to 4 km to draw water from a natural stream or lake. However, temporary dwelling sites (work camps) where Chenchu families spend 2-3 months every season, or twice a year, are constructed near a water source. In such cases they reside near a water source, in grass huts or leaf shelters; anything that provides shade and protection from environmental hazards. Proximity to a water source implies that in such work camps the primary motive would be hunting and foraging and manufacture of hunting implements. Such locations minimise the effort required to collect water. Chenchus select such sites primarily in locations where there is a seasonal or small-bodied water source on the periphery of the catchment areas.

To understand the distribution of Chenchu settlements over the landscape, certain terms used by the Chenchus with respect to settlement patterns must be defined. *'Gudisa'* refers to a Chenchu circular hut, an object of utility. A collection or distribution of *gudisas over* the settlement constitutes a *'gudem'*. The term *'penta'* refers to *gudems* pitched on a cleared spot on the grassland (Gangadharam 2003). At present, interior settlements of the Chenchus are situated mostly in the *'mydanam'* or grassland forests occurring on plain ground *(Bailu)*. Here the settlements existing in relative isolation exhibit a traditional and unique patterning.

Isolated dwelling clusters

It is rare that any two permanent settlements or base camps are built very close to one another. There is usually a minimum distance of 10 km between two adjacent settlements. Within each settlement there are clusters of huts close to each other. The occupants are generally members of a close kin group, and Chenchu settlements consist of a number of clans. Although today there is a distance of only 2-3 m between each dwelling, the Chenchus traditionally maintained up to 500 m distance between individual

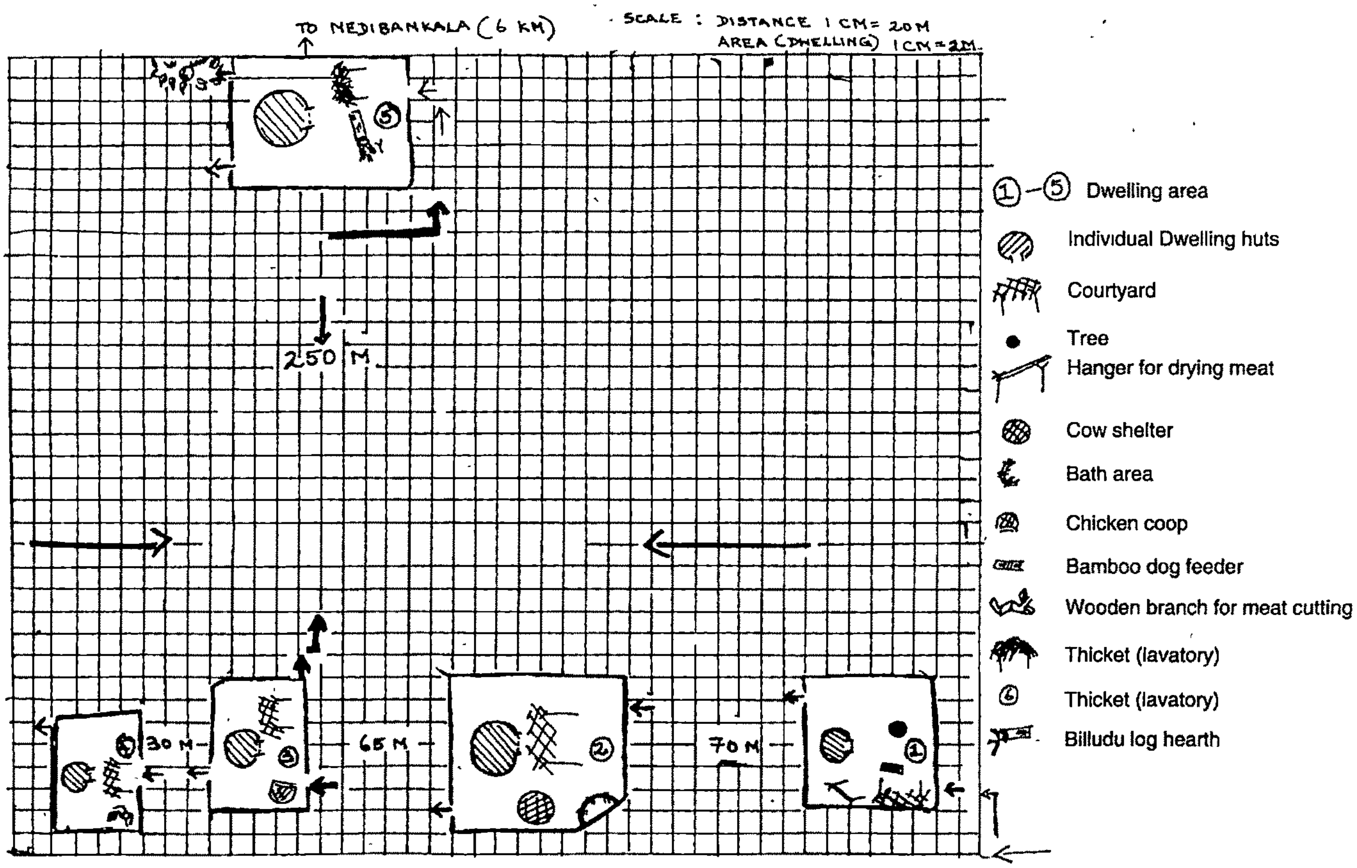


Fig. 2: Isolated dwelling pattern — Gundala settlement

dwellings. This is seen in the Chenchu settlement of Gundala (78° 5'-78° 6' N; 16° 25'-16° 30' E) in the Mahboobnagar district (Fig. 2). Surrounded by grassland forest tracts, the closest village settlement is approximately 30 km away. Here, the Chenchus practice incipient agriculture in terms of a single cornfield to sustain the settlement during the lean months of hunting and foraging. Crude agricultural implements worked both manually and with the aid of bullocks, are manufactured by the Chenchus using *billudu* wood (*Chloroxylon swistemia*). There are five dwelling areas constituting five households in the settlement. A maximum and minimum distance of 75 and 30 m is maintained between four dwellings, whereas Dwelling 5 is situated at a distance of 250 m across the field on the other side in the northern direction. Dwellings 1, 2, 3 and 5 belong to the same kin group whereas residents of Dwelling 4 have migrated from another settlement. In the archaeological context this settlement pattern could coincide with tool assemblages; and Paleolithic find spots with a concentration of tool scatters constituting a single dwelling site.

Remnant settlement pattern

The site of *Pandi Berra Penta* 8 km from Gundala represents what Rouse (1968) referred to as 'remnant settlement pattern'. Situated in the uplands, 20 km from Srisailam, this is an abandoned settlement in the grasslands. The landscape of the settlement area reveals several sandy patches (area 10 m) denoting areas occupied by circular dwellings and which are now abandoned (Fig. 3). Each dwelling patch is roughly at a distance of 4-5 m from the other. Chenchu sources state that the original settlement was abandoned nearly 300-400 years ago. Relevant for archaeology is the fact that vestiges of a single structure leave a clear mark on the landscape. Measuring 10 m in circumference, the periphery of the dwelling is surrounded by rocky boulders raising it to a height of approximately 1 m. A circular hut would have probably stood over this wall-like platform, as indicated by the presence of a three-stone hearth situated in one corner of the boulder elevation. The dwelling area is completely covered by tall forest grass *(boda geddi)*, which possibly obscures the presence of other dwellings. Chenchu tradition has it that persons of a specific clan *'bhumani'* were accepted as chieftains. It is

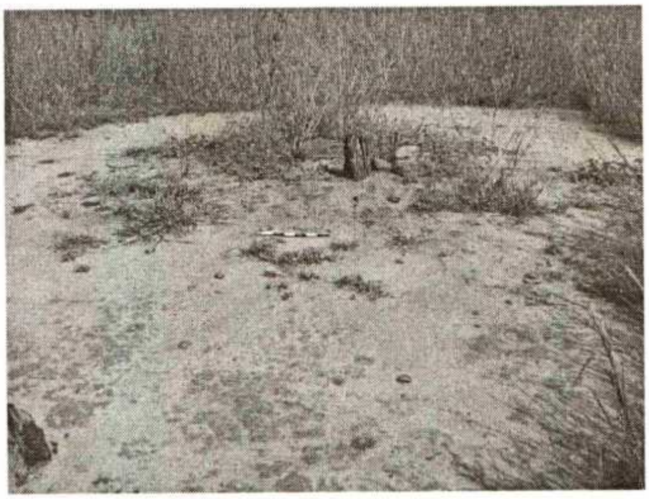


Fig. 3: Circular sandy patch of an abandoned dwelling at Pandi Berra Penta

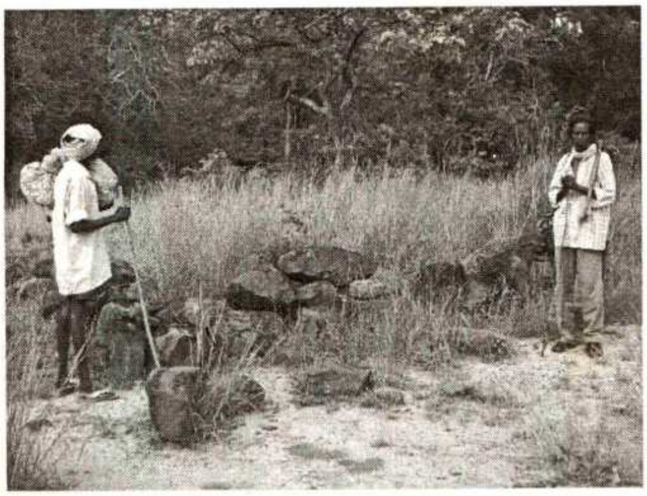


Fig. 4: Elevated stone platform (Chenchu chief's dwelling) at Pandi Berra Penta

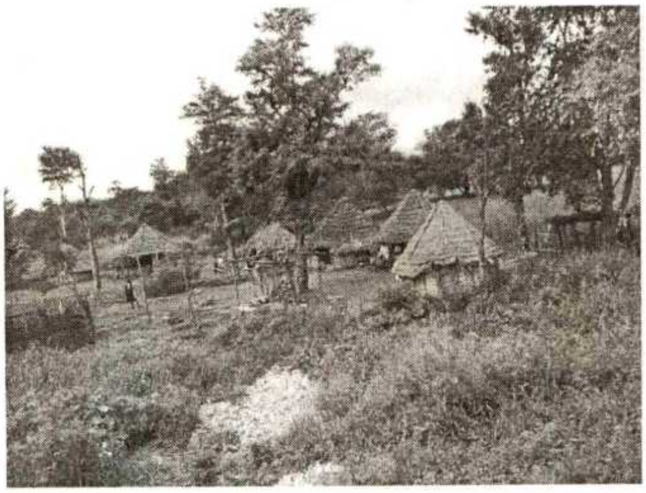


Fig. 5: Crescent-shaped settlement layout at Medibankala

possible that this elevated dwelling probably denoted the chief household of the settlement separating it from the other ground-level common dwellings. The lofty nature of the dwelling thus creates a distinct pattern on the landscape thereby ensuring its survival in the archaeological context (Fig. 4).

Crescent shaped settlement pattern

Another characteristic settlement pattern although not widespread today, is seen in interior settlements in the large tracts of grassy forestland and also observed in settlements on the *Banda* terrain. Haimendorf (1943) comments, "that the layout of these villages does not follow any definite plan. But the houses are generally arranged in a rough crescent open to the east". This settlement pattern is typically seen in the Chenchu settlement of Medibankala (78° 5'-78° 6' N; 16° 25'-16° 30' E), in the Mahboobnagar district (Fig. 5). Situated 6 km from Gundala, the antiquity of this settlement can be traced back to the presence of a *'kota'* (watch tower) at the entrance to the settlement. Chenchu sources bear that in the historic period this settlement comprised an admixture of Chenchu hunter-gatherers and agriculturalists (plains people) and the Chenchus were employed as guards at the watchtower. The abandoned area of the settlement ranges from the 'kota' to a distance of nearly 500 m. The occupied area in the settlement consists of three isolated clusters of huts denoting dwelling areas 1 and 3, each constituting members from one clan each. Dwelling area 2 occupying the centre of the settlement represents the 'crescent shaped patterning' on the landscape. This cluster consists of four circular huts, one circular prayer hut, and a goat shelter arranged in a rough semi-circular position with a hearth area in the middle, symbolic of a clan of individuals huddling around a fire; indicative of a sense of security in the arrangement of such clusters. The prayer hut denotes a unique individual structure not present in any other settlement. Cornfields all around the dwelling area signify an alternate food source in the lean months. Dwelling 3 is located around 200 m north of Dwelling 2 and is represented by a clustering of huts.

Types of Chenchu Settlements

Type Site I: Permanent Settlements (Base Camps)

Typically settlements occupying the rocky terrain consist of about 5-6 families with 15-20 individuals and denote a traditional base camp with each individual dwelling maintaining a distance 3-4 m in a semi-circular or sometimes scattered arrangement (Fig. 6). The total area occupied is roughly between 50 x 30 m. The Chenchus build circular *gudisas* or huts made of bamboo thatched with forest grass *(Dooda* or *Sirboda:* local names) The periphery of the hut is covered by bamboo wattle. Chenchu dwellings are one-roomed structures with very basic

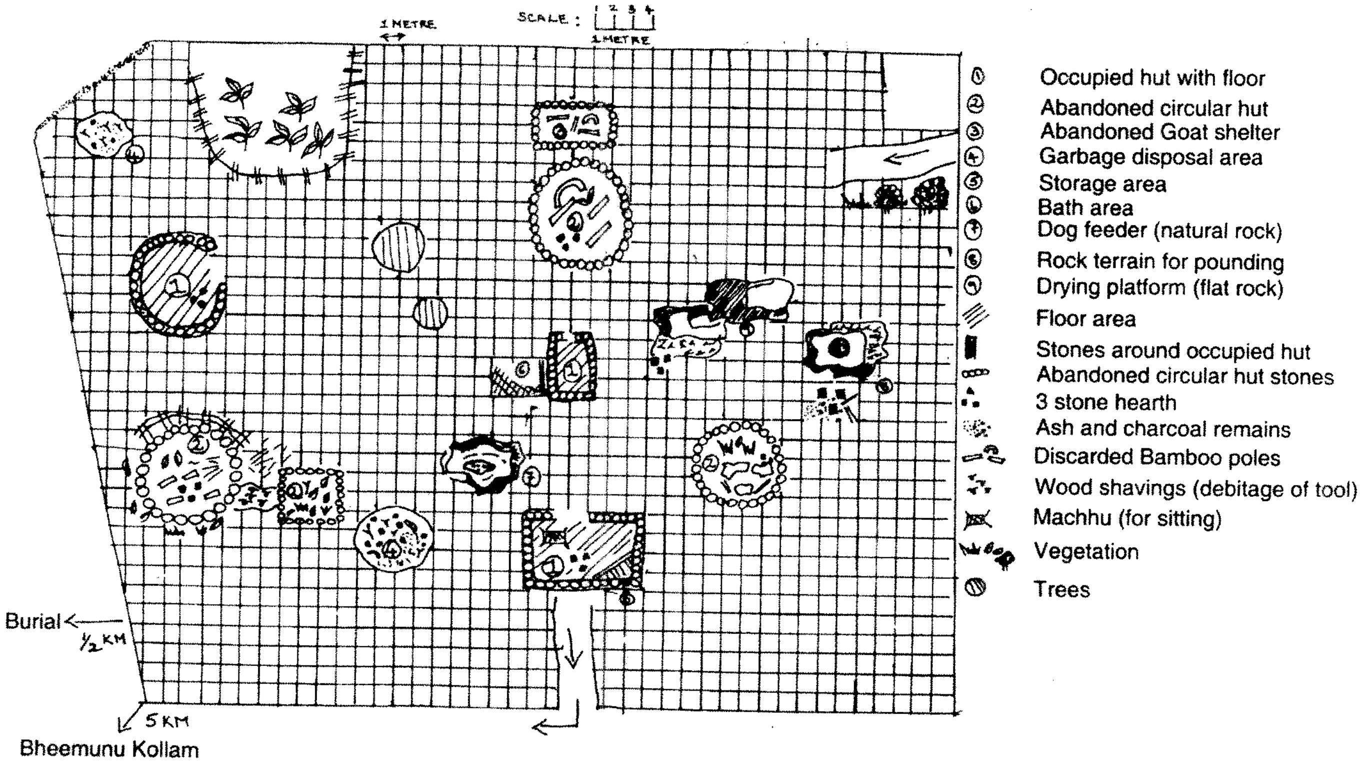


Fig. 6: Base camp (permanent settlement) — Hatakeshwaram

amenities. The entrance into the dwelling is 2 m in height and sometimes has a bamboo wattle door. The hearth usually occupies a place immediately to the left of the entrance. Some dwellings also have a bamboo screen that divides the one-roomed structure into the hearth and storage area on the left, with the sleeping area and the hunting equipment on the right. With the introduction of indoor hearths this partition is constructed to avoid the inhalation of smoke. The concept of ventilation in a Chenchu hut is nearly absent. Although the mud floor and thatched roof provide for cool interiors, the only available ventilation is through the main entrance and gaps between the woven wattle screens. Sometimes a percentage of the periphery is left open and is not covered with wattle thereby allowing cross ventilation.

Invariably every settlement has a three-stone type of hearth placed outside, occupying a central position in the settlement. Chenchus prefer to sleep around this during the night. Floors in permanent dwellings are plastered with clay and mud or with cow dung depending on availability. This floor area sometimes extends outside the front of the hut for sleeping or tool making purposes. In the interior settlements, ant hill mud is used to smear floors. Sheds for domestic animals (cattle/goats) are usually close to or adjoining dwellings. One or two sheds can house livestock of the entire settlement. Chickens are usually placed in hanging baskets to roost or are left in the open. Dogs occupy a place in the dwelling hut itself.

In terms of garbage disposal each individual permanent dwelling has its own refuse heap. Protective measures include a fence of thorny bushes and *acacia* branches surrounding each individual dwelling or in some cases enclosing two or more houses of near relatives. But generally the settlement area itself is not fenced.

Water sources for permanent settlements include seasonal/ perennial streams, springs, lakes and artificial tanks and wells (*bavi)* built during the historic period by local rulers. Hence the organisation and composition of permanent settlements is as follows:

1. Clustered arrangement of dwellings is seen in settlements occupying the plains and the plateau zones (*bailu*, duly influenced by the village pattern of settlements,
2. Semicircular patterns are typically seen in permanent settlements occupying the Banda terrain and in the interior forests (*mydanam).*

The layout shows that huts are well spaced with some distance maintained between them. Even huts belonging to one kin group are spread out. Generally small-scale permanent settlements are located in the rocky tracts as the rugged nature of the terrain prevents erection of stable dwellings and restricts the number of dwellings per settlement.

Chenchus inhabiting the rocky area and the higher reaches of the Nallamalais continue to depend solely on hunting and gathering and sale of the minor forest produce as a means of existence. But their counterparts in the plains supplement the primary occupation by incipient agriculture, crop watching and as daily wage labourers. The burial ground is 500 m to 2 km away from the base camp. Religious shrines include the arrangement of stone slabs under a tree signifying the deity. These shrines are seen within the settlement and sometimes at the approach to the habitat serving presumably as guardian deities of the settlement.

Type Site IIa: (Abandoned) Temporary Settlement (Work Camp)

This settlement type is constructed mainly for resource extractive purposes and such short-term camps are located close to the site catchment. The importance of the study of temporary settlements in an abandoned state helps in the understanding of unused or discarded material culture.

In the settlement of Pota Razu Penta (15° 59' N; 78° 54' E), Kurnool district, Chenchu work camps are situated in the vicinity of the catchment. The work site consists of two dwelling areas roughly situated opposite each other. Dwelling area 1 represents a temporary seasonally occupied camp recently abandoned and at a distance of 25 m from Dwelling area 2. The latter is also deserted but shows evidence of seasonal re-occupation. These temporary dwellings denote the activities of two kin groups in partaking of the resources from the same catchment, yet maintaining considerable distance from the other. Such dwellings are located in a cleared spot in the forest. Dwelling area 1 covers an area of 16 x 14 m. The dwelling itself shows signs of recent abandonment in that the structure has only partially collapsed, mostly due to continuous seasonal rains. The dwelling has a tent-like appearance with two Y-shaped bamboo poles erected at a distance of 2 m in from each other in the north-south position. A sturdy crossbeam is placed in the fork above the vertical standing poles. Long bamboo poles (8-9 in number) are bent across the horizontal cross beam and the ends of the bent poles are inserted into the ground on either side resembling a tent (Fig. 7). The structure is then completely covered with dry forest grass.

The vestiges of material culture seen at this type site includes three-stone hearth, one placed inside the dwelling for cooking and to provide warmth, the other placed outside in the centre of the settlement area and lit to keep wild animals away from the settlement at night. Another purpose of this external hearth is in the manufacture of Chenchu hunting tools (fire used to haft the iron arrow head to the wooden arrow). This is also seen in the presence of a polishing stone slab for sharpening iron implements placed next to the hearth. Evidence of bamboo cane dog-feeders indicates the use of dogs for hunting (Fig. 8).

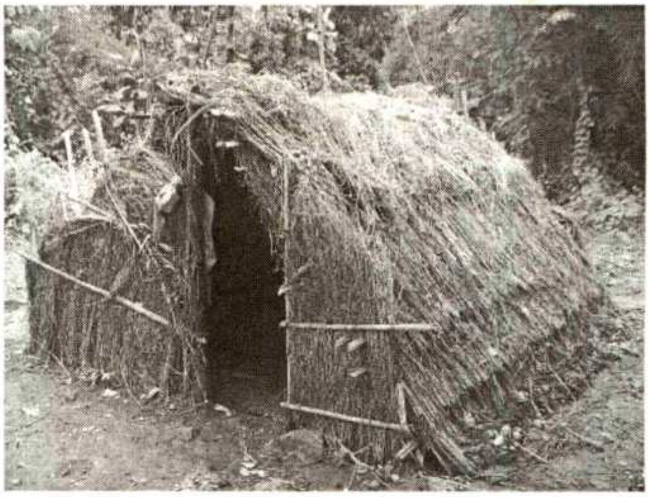


Fig. 7: Type site I la. temporary dwelling 2 at Potarazu Penta

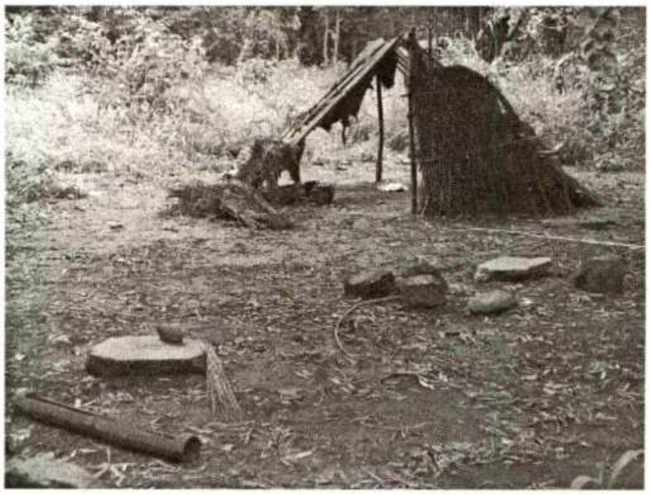


Fig. 8: Type site I la. Temporary dwelling I (abandoned). Also seen is bamboo dog feeder, grinding stone and Hearth (with tool polishing stone)

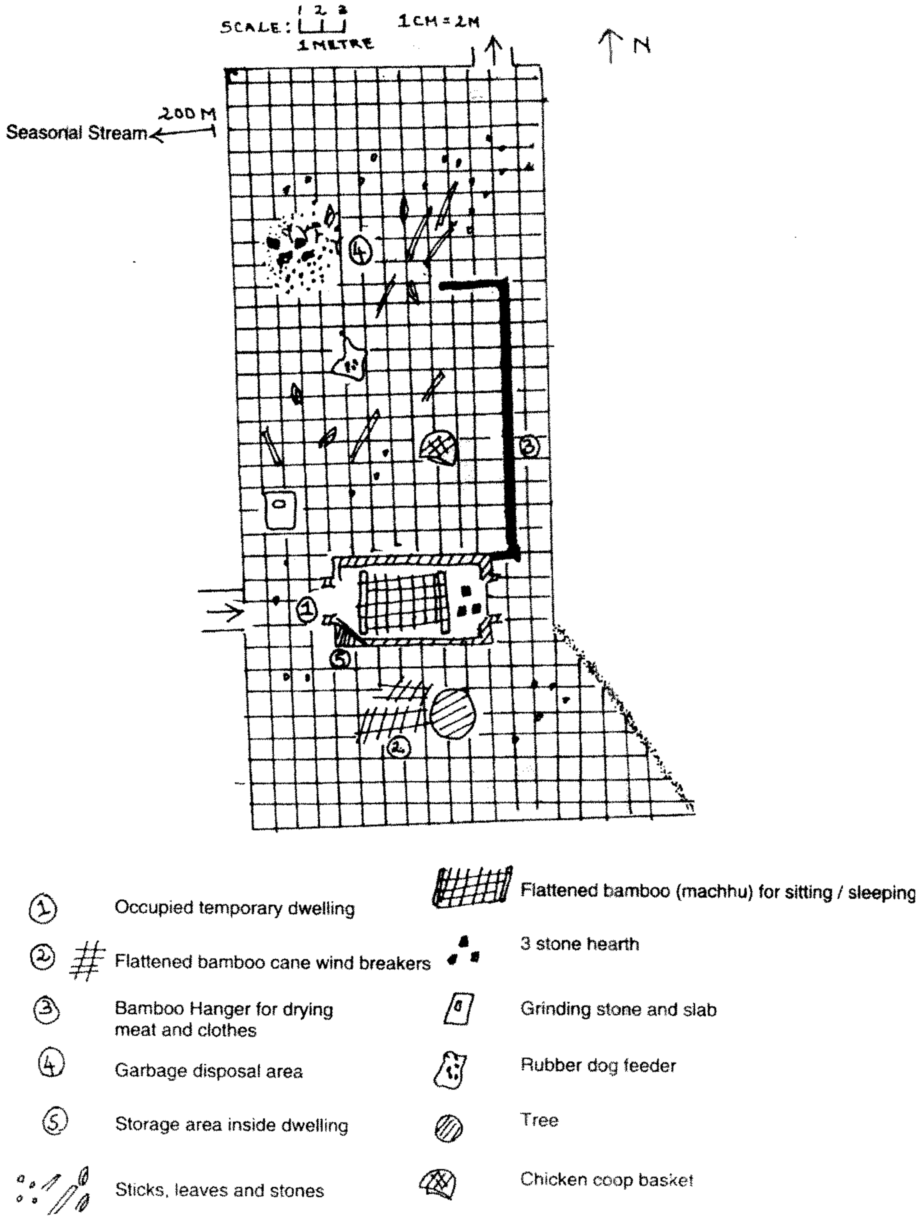
Food preparation activities in work camps involve simple processing of the meat and plant foods before cooking and consumption. Food processing equipment like grinding stones and slab and pestles (*pappu geeti*) made from *billudu* wood (*Chloroxylon swistemia*) are used.

A survey of the resource area surrounding the settlement up to a distance of 1 km brought to light several types of medicinal plants, tubers and other plant food within the catchment area. Raw material for constructing structures seem to have been obtained from the bamboo grove in the centre of the dwelling area itself.

Dwelling area 2 covers a larger space than Dwelling area 1, and measures 23 x 20 m (Fig. 9, please see inside back cover). The dwelling structure although presently deserted, stands intact demonstrating periodic occupation. Protective measures against snakes and insects involve a combination of sharp stones and mud plastered along the exterior sides of the hut. The material vestiges are similar to Dwelling 1 in all respects. These dwellings consist of 1-2 families of 4-5 individuals each.

Type Site IIb (Occupied) Temporary settlement (Work Camp)

The Chenchu base camp at Rollapenta (15° 59'; 78° 54' E), Prakasam district contains within its catchment area the temporary work site denoted as Dwelling area 3. The campsite occupies an area of 30 x 20 m and is inhabited by a single family of four members from Rollapenta base camp (Fig. 10). The site is situated 200 m away from a seasonal stream providing a water source flowing during the rains from July till October This is ideal as this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Seasonal Stream
4
3
1
5
2
1 Occupied temporary dwelling
2 Flattened bamboo cane wind breakers
3 Bamboo Hanger for drying meat and clothes
4 Garbage disposal area
5 Storage area inside dwelling
Sticks, leaves and stones
Flattened bamboo (machhu) for sitting / sleeping
3 stone hearth
Grinding stone and slab
Rubber dog feeder
Tree
Chicken coop basket

Fig. 10: Type Site II b (occupied) seasonal dwelling (Rollapenta)

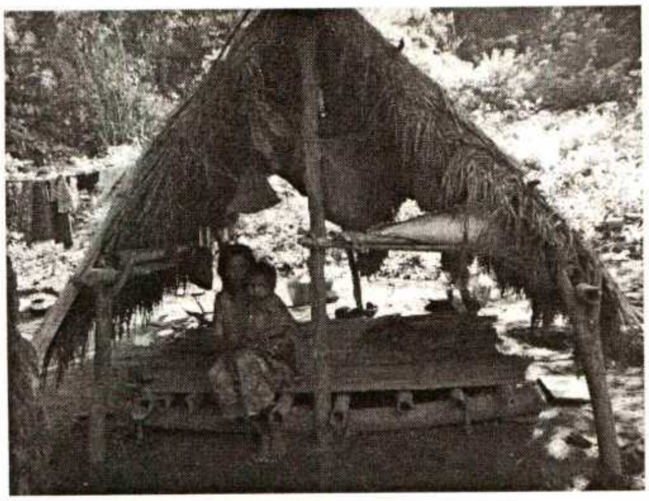

Fig. 11: Type site II b (occupied) seasonal dwelling at work camp in Rollapenta

settlement is a seasonal occupation site. The dwelling structure differs slightly in model and construction type (Fig. 11). Y-shaped short poles measuring 1 m of *billudu* wood are placed on four sides. Two cross beams measuring 4 m are placed horizontally on the fork tops. Two Y- poles 2 m each are placed in the north-south direction with a horizontal cross beam on top. Bamboo rafters are tied across in a slanting position constituting the roof, which is then covered by dry forest grass. In the interior of the hut, the sleeping/sitting area consists of a criss-cross arrangement of bamboo poles over which bamboo matting is laid at a slight elevation above the floor serving as a protective measure against snakes and insects. The bamboo matting is made by flattening out bamboo cane layers using stone blocks or boulders. The matting covers 3-4 m of the inside of the hut occupying nearly the entire ground in the place of an occupation floor. The dwelling structure is completely open on two sides for cross-ventilation and can be entered through both the front and the back. Thus, layers of bamboo matting are placed against the openings as wind-breakers against rain and strong winds. A three-stone hearth seen at the back of the dwelling. Also unique is the erection outside the dwelling of two thin bamboo fork poles inserted into the ground and a horizontal cross bar with the pole on the right end attached to the back of the dwelling structure for added support. This device serves as a hanger for drying both clothes and meat.

For feeding dogs a slightly curved discarded rubber sheet (industrial waste), is used. The disposal area is 6-7 m away from the dwelling, but within the settlement area. The settlement is surrounded by a catchment area of approximately 15-20 km.

Type Site III: Transient Camps (Open- air Settlements)

This category of sites includes natural rock shelters (series of projecting slabs) and tree shade occupations. Some Chenchus also forsake shady areas in such transient camps and live out in the open if the availability of resources is greater in certain locations of the catchment area. The documentation of the rock shelter at Bheemunu kollam (Fig. 12, please see inside back cover) represents a transient encampment of the Chenchus in Srisailam. It is situated at a distance of 4 km from the base camp at Hatakeswaram (16° 20' N; 78° 57' E) and is occupied by several families of the settlement of Mekhalabanda (16° 35' N; 78° 57' E) located 3 km away, and constituting kin group and clan members of the former settlement. The rock shelter is situated at a lower height than the base camp. The sequence of Archaen rocks extend up to 3 km, but the length of the rock shelter inhabited by the Chenchus measures approximately 18 m in length and is situated on the smooth flat *Banda* terrain typical in this region. The occupied campsite faces the 'kollam' (lake), a perennial water source fed by monsoon showers from July till September. The distance from the occupied area of the shelter to the lake measures roughly 10 m. Activities at the encampment include distribution of plant and animal food collected from the catchment between the representative members of the kin group to take back to their respective families in the base camp. Cooking and collective eating of a portion of the game is part of activities at such sites.

The duration of stay at such encampments ranges from an overnight stay to a few days. Within the context of the above-mentioned activities, material remains include two hearths on either end of the occupied area, the double-hearth used for cooking and the other three stone hearths to provide warmth. The sleeping area comprises the flat stone base of the rock shelter and the protruding rock slab at a slight elevation (mostly for children who accompany their parents. Usually 1-2 families of 5-6 individuals from the same kin group or clan occupy the site at the same time. Dogs accompany the Chenchus on hunting trips to such encampments. The material vestiges at such sites are negligible due to the limited duration of occupation and activities. The remains of the activities at such camps are washed away during the rainy season, owing to the smooth sloping nature of the terrain and by the periodic flow of the seasonal springs.

The term open-air settlements can also be applied to those shelters occupied under the shade of trees. The Chenchus however inhabit bamboo groves in the forest where a thicket of bamboo is bent across, the ends are inserted into the ground and held together by stones. The strength of the bamboo prevents it from springing back from its fixed position and thereby creating habitation space under this man-made shelter. The duration of stay is generally during the rains in the monsoon and against the

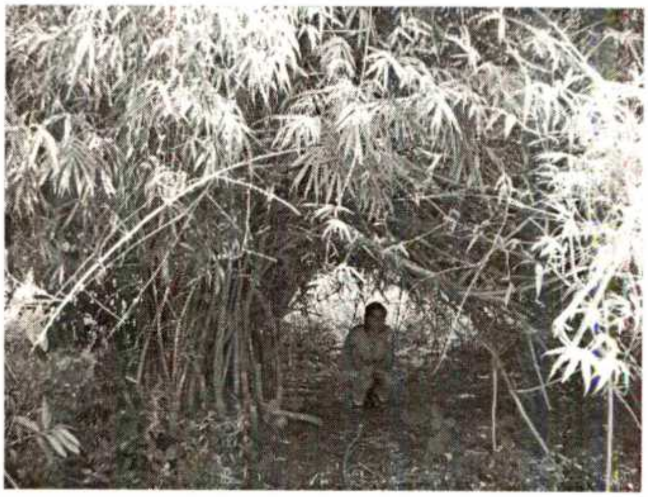

Fig. 13: Type site III: bamboo grove shelter

sun, or on an overnight basis. Material culture is minimal and includes a hearth, polishing stones for tools, and the absence of occupation floors all denoting a transient encampment (Fig. 13).

Construction of Chenchu Dwellings (*Banda* vs. *Bailu*) and the Use of Terrain

The construction of Chenchu dwellings depends on the nature of the terrain occupied. The attributes of a typical circular hut are as follows:

1. Central pole: *'nitudu'*,made from *sirman* or *billudu* wood.
2. Support poles or short poles: locally referred to as *'gunjalu'* made from *sirman billudu, devadari, medimanu* (all types of forest wood). The number of short poles ranges from 10 or 12 to 19 depending on the size of the hut. They are inserted around the central post.
3. Bamboo wattle: is of two types: '*Dadi*', which is better woven with daub and '*Thadaka*' which is much finer, and woven with fewer strips of bamboo.
4. Rafters: also called '*vedurlu*' made from bamboo are tied from the top of the central pole to the short poles, using '*nara vepa* (forest fibre). Rafters are of two varieties; '*chitalu*' (thinly cut bamboo sticks) and '*baarlu*' (thick sturdy bamboo sticks).
5. Grass roofs: are covered with grass acquired from the forest and dried. The two varieties are '*sirboda*' and '*dooda*' (local names).
6. Floor: covered with small stones mixed with mud and sometimes plastered with cow dung.

Construction Method on the *Banda* and *Bailu* Terrain and its Survival in the Archaeological Context

Chenchu settlements in Srisailam and the surrounding area inhabit the '*Banda*' tract. The terrain itself is an undulating surface with natural flat rock. Consequently the layout of the dwellings is uneven with ups and downs. In construction, the central pole is inserted not into the ground, but is placed erect on a boulder and held together firmly by a mixture of sticky red mud and stones. Surrounding the central post, the support poles are erected by inserting them in the crevice or gap between the flat boulder surfaces or by fixing them firmly between a circular arrangement of large stones all around the periphery of the dwelling.

A mixture of clayey mud and small stones are used to strengthen the support poles for stability (Fig. 14). The rafters of bamboo are then tied from the top of the central post to the short poles and are secured by forest fibre. The periphery of the hut is then covered by bamboo wattle. The roof is then covered by bundles of grass.

These stones support dwellings in the case of a collapse especially during the monsoon and are rebuilt without much effort. In the case of abandonment or destruction of such dwellings, the vestiges merely include circular arrangement of stones and the evidence of a hearth within the periphery (Fig. 15, please see inside back cover). These stones are then reused in the construction of other dwellings and the surrounding forest vegetation soon covers the dwelling space. Thus no marked evidence of a structure remains on the landscape. This obvious absence of postholes, permanent hearths and floors in the ethnographic record is also noted as a lack of structural evidence in the archaeological context.

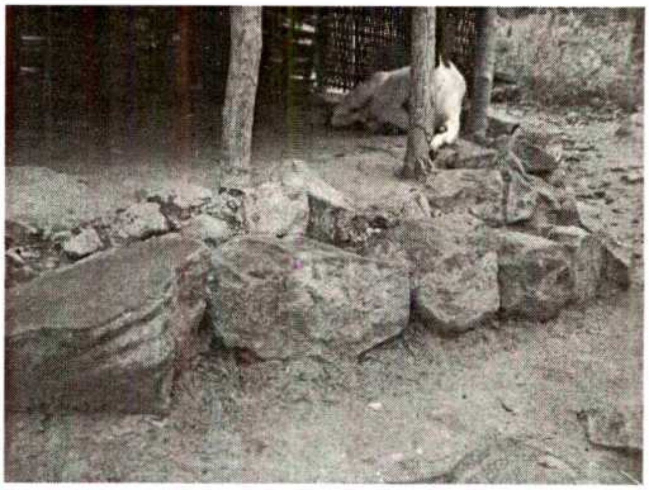

Fig. 14: Support poles propped up by stones and plastered with mud and cow dung

Construction of circular dwellings in the '*bailu*' (flat land of the valleys and plains) is partly influenced by the village system. Although the actual design, construction and layout retain Chenchu building traditions, it is at the foundation level of the dwelling that the influence of acculturation and nature of the terrain play a predominant role. The central post is firmly inserted nearly 1 m into the earth and the support poles too are inset deep into the ground. The floor is re-plastered with several layers of mud and cow dung. Bamboo wattle is *thadaka* variety, intricately woven and plastered with daub (cow dung and mud). The central post and short poles are thicker (13-50 cm in width). The circumference of the dwellings ranges from 15-20 m.

Use of the Terrain

In rocky tracts the numbers of dwellings are fewer and sparsely arranged. In general, the embedded flat rock surface is avoided for construction of the Chenchu huts but utilised for other purposes. The flat rock terrain is used as a drying platform for forest tubers and other plant produce collected during the day. Medicinal plants like roots of *palagedda sugandi (Dacalapus indicus)* collected by the Chenchus, are dried for several days on such rock platforms and made into a beverage to overcome the heat. Another purpose for using such terrain is the presence of low-lying depressions or natural craters on the surface of the rocks caused due to weathering. It has been observed that these depressions are used to place food in for the dogs. Often, the Chenchus eat right off the '*Banda*' themselves. In terms of food processing activities, a hole or perforation is made on the rock surface whereby red chillies, onions and even medicinal plants are pounded using a wooden pestle *'pappu geeti'* made from '*billudu*' wood.

Minor Structures

Hearths: The hearth referred to as '*poyya*' by the Chenchus is used for roasting/cooking food and to provide warmth during the night, as well as to keep wild animals away from the settlement area. In some Chenchu settlements especially those situated in the plains and valleys away from the '*Banda*', the influence of the village system prevails influencing Chenchu material culture including hearths. Thus Chenchu hearths are divided into two categories based on their degree of durability and permanence in the archaeological record: (1) impermanent/movable hearths, and (2) permanent hearths.

Impermanent hearths — This category includes traditional Chenchu hearths. Such hearths are subject to easy displacement and destruction or reuse in the case of abandonment or ruination of the dwelling and of the settlement. The three varieties of movable hearths are:

(i) Three stone type: In this type three medium stones are placed in a roughly triangular fashion. Although such hearths are mostly placed outside the dwelling, today the three stone hearth occupies a place in side the hut usually by the left of the entrance where it is partially embedded in the floor to minimise the emission of smoke. Cooking by boiling and steaming meat and tubers within pots inside the hut, while roasting is done in the hearth outside.

(ii) Double hearth: A variation to this variety of hearth is the double hearth (three stone type) where in addition to the triangular arrangement of stones, an additional stone is placed on top by the side of the headstone creating a dual hearth space. In such cases, two cooking vessels can be simultaneously placed on one such hearth or in another case, one section is used as a hearth for warming and the other for roasting food. Fuelling agents include sticks, leaves, slivers of wood, etc.

(iii) Log hearths: The Chenchus in the interior forest dwellings of the Nallamalais use this type of hearth due to the greater availability of *billudu* wood in these parts. The wood of the *billudu* tree *(Chloroxylon swistemia)* is inflammable and is of considerable thickness. In making this hearth a small portion of a wooden log is scooped out and fuelling agents like sticks, branches, leaves, grass and wood slivers are placed in this hollow space where the fire is lit. This serves as a hearth for warmth, especially during the night, and is placed both inside and outside the dwelling. Such log hearths are used and discarded every 2-3 days. Ash and charcoal remains are usually abundant in such hearths (Fig. 16).

(iv) Permanent hearths: The existence of this category of hearths reveals a degree of acculturation in Chenchu

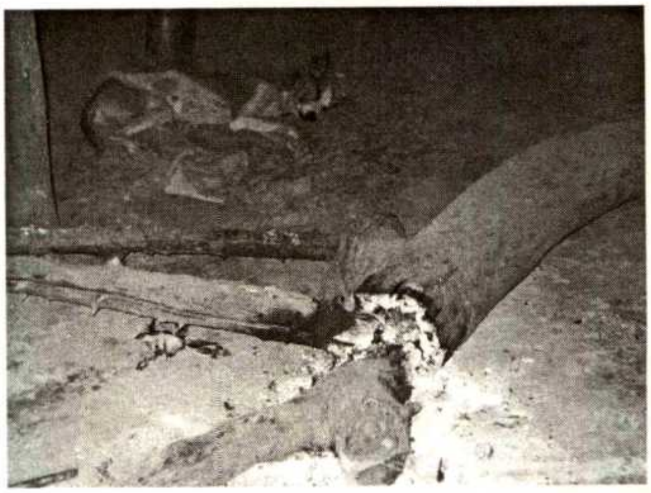

Fig. 16: '*Billudu*' log hearth

settlements. Such hearths are not widespread in Chenchu dwellings situated in the '*Bailu*' terrain or in those occurring in the '*mydanam*' (forest settlements on plain ground). There are two types of hearths in this category:

(a) Fixed three stone hearth with anthill mud support: This type of hearth includes the typical triangular plan of three stones but has an auxiliary mud support measuring15 cm encasing the hearth on one side. This support made of mud from anthills abundant in the forest has great viscosity and covers the two side stones of the hearth as well as the surrounding hut floor. The height of the support is slightly higher than the level of the hearth stones, thus serving as a wind-breaker.

(b) Mud and clay plastered brick hearth: Such hearths bear a direct resemblance to those used in agricultural villages and are seen in those Chenchu settlements located in close proximity to these village settlements. The hearth consists of two levels of bricks arranged on one another and plastered with clay and mud.

This ethnographic study of various Chenchu hearth types leads to the following conclusions:

1. Conventional hearths reveal the very essence in the nature of nomadic hunter- gatherers in that they are temporary simple devices and prone to easy displacement. Such hearths would leave behind negligible evidence except for perhaps charcoal, ash and other fuel remains.
2. With regard to the category of permanent hearths, their introduction into Chenchu settlements itself can present a case of a 'partially' settled life. The hearths symbolise a greater degree of durability and stability of the agro-pastoral village economy. Although they in turn influence the Chenchus adapting to the plains, they in no way reflect the true material culture of the Chenchus of the Nallamalais.

Structures for Domestic Animals and Feeding Devices

Animal shelters in Chenchu settlements are mostly seen only in the base camps or permanent settlements. Except in the case of hunting dogs, domestic animals do not occupy a place in temporary and transient encampments. The introduction of animal husbandry into Chenchu settlements is a relatively recent phenomenon. Animals are mostly received in barter or bought in exchange for forest produce. In the case of small agricultural plots, cattle are used to work the fields; and cow dung is used to pave the dwelling floors. The Chenchus sometimes supplement the meat of wild game with cattle/goat meat, mostly on occasions when the availability of hunted meat is scarce. Domestic animals provide a sense of security during lean times of hunting and gathering, and are sold in exchange for food and clothing from the plains. The number of animals per settlement include an average of 5-6 cattle and 8-10 goats with 4-5 chicken. In the case of hunting dogs, a single family in the settlement generally raise 1-2 dogs.

Dogs occupy an important position in the life of the Chenchus and are kept within the dwelling hut. They accompany the Chenchus on daily hunting expeditions and also reside in temporary dwellings and transient camps during seasonal trips.

Animal (dog) Feeding Devices

The evidence of the presence of hunting dogs in Chenchu settlements is denoted mainly by the indication of the use of devices to feed dogs. The meal consists of leftover rice gruel or bone remains.

Use of the natural terrain: The natural craters and low-lying depressions caused due to weathering of the flat rock surface (*banda*) serve as a natural feeder for the dogs especially in base camps situated on this terrain.

Wooden feeder (with handle): A hollow is made in a sturdy stump of wood or a short wooden log measuring 1 m by scooping out a portion from the top, and a handle is carved out of the side of the log.

Bamboo dog feeder: The top of a thick bamboo pole (1.20 m in length) is neatly sliced off, leaving a gap on either side of the pole, revealing the natural hollow centre of the bamboo wherein the food for the dogs is placed.

Rubber (industrial waste) dog feeder: The industrial discards from factories like rubber or metallic sheets are curved and used as feeding devices.

Food processing Equipment

Within base camps, during the daily foraging and hunting trips, small game is skinned and brought back to the settlement along with plant food. This is further cut into smaller pieces, cooked and consumed, or cut into strips and dried in the sun for later consumption. Activities in these sites are generally restricted to cooking and sleeping. Transient camps occupied by the Chenchus are usually located by the side of a perennial stream or lake.

In case of transient encampments, a portion of the produce acquired is consumed and the remaining is shared between the Chenchus to carry home to their respective families. Large animals are never carried intact but are skinned and divided in the forest itself. Thus base camps and work camps serve as the final processing sites before cooking and consumption of the produce.

Use of the rocky terrain for pounding: As mentioned earlier, a hole or cavity of 0.15 m in depth is made on the

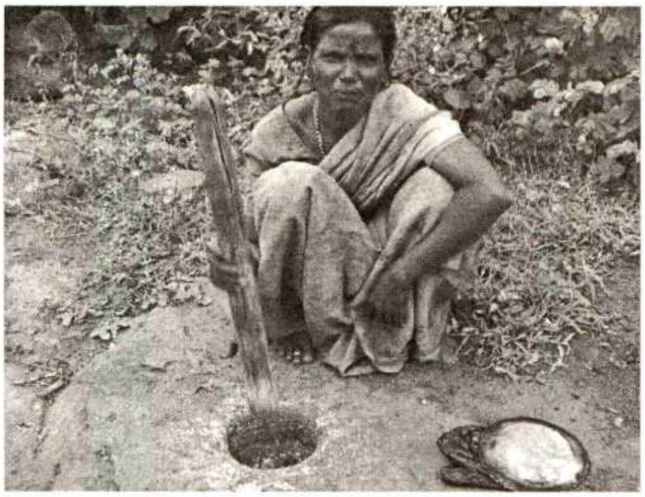

Fig. 17: Use of terrain — food processing equipment — Chenchu woman pounding spices with *'Billudu'* wood pestle

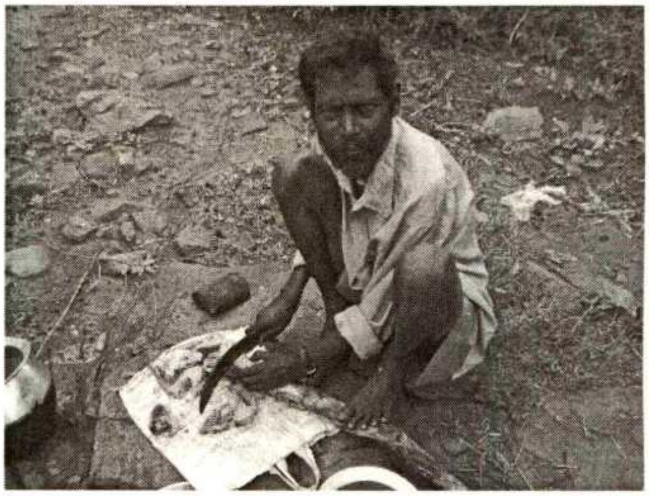

Fig. 18: Meat cutting device using *'Billudu'* branch and iron knife

'Banda' surface, whereby red chillies, onions and medicinal plants are pounded using a pestle of *'billudu'* wood measuring 60 cm in length and 10 cm in thickness (Fig. 17).

Meat/tuber drying platform: The natural *'Banda'* terrain is also used to sun-dry meat for later consumption and in drying medicinal plants and tubers.

Wooden beam for meat drying: During the rainy season, meat cannot be dried outside in the usual fashion. Instead a wooden beam or a long stick is placed inside the dwelling, positioned and tied to the rafters occupying one corner of the hut. Strips of meat are hung across this beam and allowed to dry for one to two weeks.

Meat cutting platform (wood branch) and knife: Meat obtained by hunting is further processed by cutting it into smaller pieces in the settlement before cooking and consumption. For this process, the sturdy branch of the *'billudu'* tree is cut and scraped smooth. The Chenchu sits on the ground holding one end of the branch down with his foot. The meat is then cut with a wooden handled iron knife using the branch as a cutting board. The cutting action results in the evidence of 'cut marks' on the wood (Fig. 18).

Grinding stone and slab: A flat stone slab and natural smooth stone are used to grind spices and forest roots, etc. The stone slab is usually part of a larger boulder and is broken off and carried to the settlement.

Storage by Fermentation: The *Mohua* tree blossoms (*Bassia latifolia*) from March till May. The Chenchus consume the seeds and flowers seasonally and also store the blossoms for preparing liquor. For this purpose, the flowers are dried and stored in pots and buried inside the ground or stored in a corner of the hut. An alternate storage method in liquor preparation involves the powdering of the bark of three species of forest shrubs; *pulsara chekka, vepa chekka and thumma chekka* added to a concoction of jaggery and water. This is buried in a pot in the ground for 10 days to ferment.

Garbage Disposal and Drainage Facilities

In terms of garbage disposal, both in the permanent settlements and work camps, each individual dwelling has its own refuse heap 6-8 m at the back, or by the side of the dwelling. Most waste products in the disposal area contain organic matter like animal bones, plant remains and other biodegradable waste.

Disposal methods in base camps: In Chenchu permanent settlements, garbage is disposed off in two ways. The refuse is collected along with animal dung and ash from the hearth area and is used as fertiliser or manure in the vegetable gardens grown within the settlement area or in small agricultural plots. In most cases, in the absence of fields, garbage from each dwelling is piled along with the hearth residues (ash, charcoal) 6 m outside each dwelling. Human faeces are disposed off outside the settlement area or by the side of a stream.

In terms of drainage facilities, in base camps or long-term sites, acculturation is seen with the introduction of *'jalladi'* or bathroom, an enclosure surrounded by a wire mesh or wattle screen. Sometimes, a narrow passage is dug to let the water out of the settlement. In the *'banda'* terrain, the sloping nature of the rock surface, facilitates this flow especially during the monsoons.

Garbage Disposal in temporary dwellings (work camps): The refuse is disposed off in a similar manner. Meat procured during hunting, and other food gathered are processed within the catchment. Sometimes they are carried to the work camps, if nearby, for processing, cooking and consumption. Residual remains at such sites include ash, charcoal, bones, etc. Faeces are disposed off in the forest.

Disposal Methods in Transient Encampments: Rock shelters are currently occupied for a short duration only. Evidence of activities is minimal and largely washed off owing to the smooth rock surfaces. Sometimes waste matter is thrown into a seasonal stream or lake located nearby.

Chenchu Burials

Funerary practices of the Chenchus include burial and cremation, although the former is more widely practised. The burial area is usually 500 m to 2 km away from the settlement. The body is never buried within the settlement or even close by, due to their inherent fear of spirits and the dead. The burial method involves measuring the length of the body by placing a stick of equal span next to it, and the latter thereby serves as a scale for the length of the pit to be dug. The pit is usually dug to a depth of 1 m or less and traditionally the body is placed face down, with the hands by the sides and the head turned eastwards. The pit is then covered with soil, stones and thorny twigs and is finally piled high with large stones indicating a burial mound (Fig. 19). This stone pile prevents scavenging by animals and is an obvious mark to identify the burial. If a person dies in transit, or at a work camp, the body is either carried back to the settlement or buried along the way. In such cases a smaller mound of stones covers the burial.

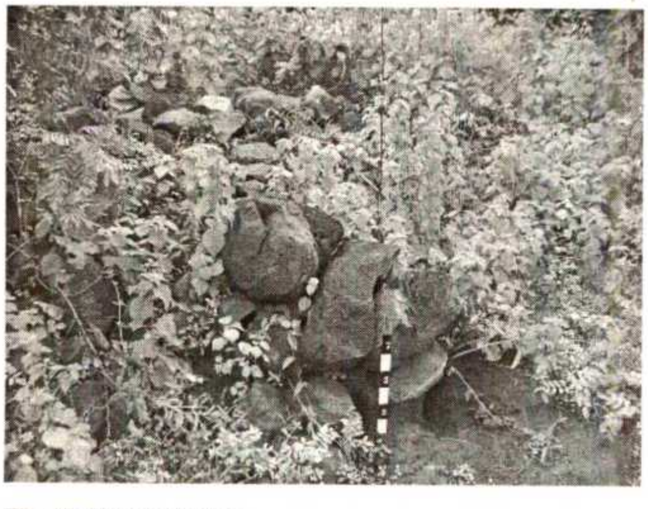

Fig. 19: Chenchu burials

In the Hatakeshwaram settlement (16° 35'N; 78° 57' E) the burial area is to the southeast of the settlement, approximately 200 m away. The residents of the settlement believe that some of the early burials are 300-400 years old or even earlier. It was observed that the burial mounds were covered by an over growth of vegetation. It was noted that boulders covering earlier burials were reused owing to the lack of easy availability of large stones; and to reduce the effort involved in bringing these stones from elsewhere. With the absence of stone cappings, earlier burials were no longer noticeable on the landscape marked only by a scatter of a few stones. Thus, in the archaeological context, the possibility of identifying such burials remains difficult. Burial goods consisting of hunting tools (bow and arrow) and the digging stick belonging to the deceased individual are placed in the pit.

Religious life

According to Chenchu religious tradition when a person dies in a settlement, the dwelling where he/she resided is burnt or abandoned and the other members of the family relocate to another settlement or move a short distance away. Gangadharam (2003) comments that the ruination/abandonment of the hut is meant to confuse the '*jiv*' (spirit) about its resting place. Worship of the dead or ancestor worship is not prevalent among the Chenchus. After the mourning period of 11 days that follows the burial, the deceased is forgotten and the quest for survival continues.

Chenchu religion comprises a pantheon of gods, including village and folk deities drawn from Hinduism or the established religion. In the traditional Chenchu religion, deities are represented by stone slabs on a raised mound under the shade of a tree. In the settlement of Thummalabailu (15° 57' N; 78° 55' E), stone slabs and smaller rocks representing the seven sisters and one brother are arranged on a stone platform. The sister deities are Peddamma, Isodamma, Haramma, Ankalamma, Arikalamma, Nulakalamma and Asukta; with their brother Pota Razu. This shrine is erected in the centre of the settlement. Similarly in the Chenchu settlement of Peddamantanala, the evidence of a stone carved panel representing faces of the seven mothers, probably dating back to the historic period is seen in the temple courtyard of Chenchu goddess Peddamantralamma. In the Peddacheruvu settlement (15° 58'N; 78° 50' E), a stone slab representing the deity Bayanna is placed under a makeshift shade of four sticks supporting a wooden sloping roof. Facing the deity a few feet away is a probable sacrificial or offering altar, adhering to the traditional Chenchu belief that a small part of the game hunted or food gathered must be sacrificed or offered to propitiate the deity. The presence of such a shrine in the forest en-route to the settlement denotes the representation of a guardian deity protecting the residents of the settlement.

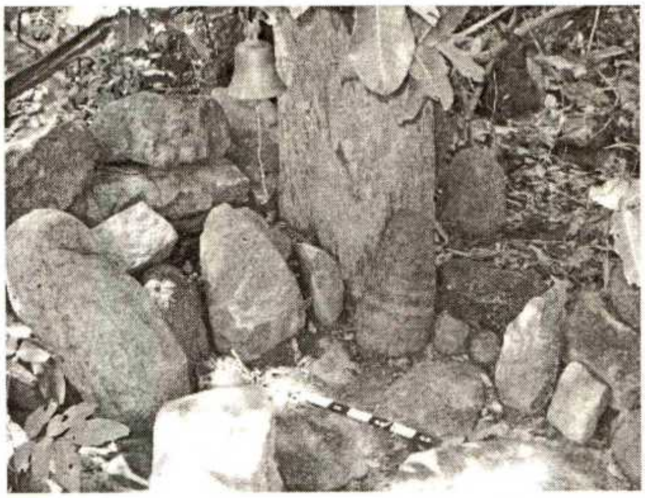

Fig. 20: Arrangement of stones signifying shrine of the Chenchu god Lingamayya

Bayanna is represented as the god of hunting and his vehicle or '*vahana*' is the dog. The shrine of Lingamayya in the forest on the route to Pandi Berra Penta, is placed under the shade of a tree and the stone representing the deity is peculiarly shaped like the 'phallus' similar to the Shiva lingam. It is surrounded by smaller arrangements of stones. The deity is given an offering of leaves and flowers (Fig. 20). A unique feature is observed in the settlement of Medibankala (16° 25'-16° 30' N and 78° 5'-78° 6' E). Here a separate circular hut has been constructed to house the deities. This prayer hut is unique in that it contains several stones symbolising various deities along with pottery. One distinctive pot made of copper is decorated with details of the ten incarnations of Vishnu. The residents claim that this pot is an heirloom, gifted to an early resident of the settlement by a ruler in whose army the Chenchu served.

Patterns of Migration

The traditional nomadic way of life of the Chenchus, though almost obsolete still exists and the tribe does migrate owing to various reasons. These include daily movements and seasonal migrations.

Daily movements involving foraging and hunting trips into the forest at dawn, and returning to the settlement the same evening with resources (Gangadharam 2003). Seasonal migrations into the forest involve residing in temporary grass dwellings in search of seasonally available resources and also to visit kin groups and relatives in other settlements.

The third broad category in settlement migrations, although not frequent, is important with regard to archaeology. This involves a residential shift where the permanent settlement is deserted and the Chenchu population shifts residence to a different locality. The abandonment of a permanent settlement or base camp is mostly due to depletion of resources. This may also be due to friction between clans or a kin group, where an entire clan or a number of residents may leave a permanent settlement and shift residence.

The function of these residential shifts can be demonstrated by an example from the site of Hatakeshwaram. This base camp was established nearly 10 years ago. The Chenchus of this settlement originally resided in Mekhala Banda settlement about 3 km on the west. Due to an increase in population and availability of better resources at the new site, as well as owing to several other factors, like forest laws, and activities of tribal development agencies. At first, two families from Mekhala Banda shifted residence and established two huts 500 m away from the present site of Hatakeshwaram. As the other families from Mekhala Banda soon joined them, the settlement was shifted to a larger area 2 km away and named 'Pitta'. For unknown reasons this site was soon deserted and the Chenchus finally established residence at Hatakeshwaram. A kin group from Chinnarutla 15 km away also joined them. These factors also caused migration of Chenchus from the interior and on the rocky terrain towards the plains and roadside settlements like Mekhalabanda, Hatakeshwaram, Chinnarutla, Thummalabailu, etc. They still retain their identity as hunter-gatherers and continue seasonal and daily migrations into the forest.

The ethnographic model of these seasonal migrations within the permanent settlements provides a possible parallel to reconstruct abandonment and relocation of base camps and work camps in the archaeological context.

Archaeological Evidence

Within the parameters of the Nallamalai hill ranges and its periphery, Palaeolithic find spots from the late Acheulian to the early Upper Palaeolithic were discovered. These occur mostly on hill slopes and on flat rocky surfaces and are mostly surface occurences (Raju *et al.* 1997). These include the cave site at Kadilivanam (Mahboobnagar district) measuring 150 x 50 x 5 m, en route to Srisailam (Reddy 2001: 2). Within the area of Srisailam town itself nearly five sites have been listed. These include surface finds, at the Chenchu transient encampment at Bheemunu Kollam which has artefacts on top of the rock shelter (N. Chandramouli, personal communication). The site of Neerukalla Ganga now occupied by the present day Chenchu settlement of Mekhalabanda has a concentration of surface tools (Narayana Murthy, personal communication) (Fig. 21) About 1 km west of the Srisailam temple surface scatters were discovered by the author at the site of Mallamma Kaneeru named after the perennial spring of the same name (Fig. 22). In the plateau zones and the plains

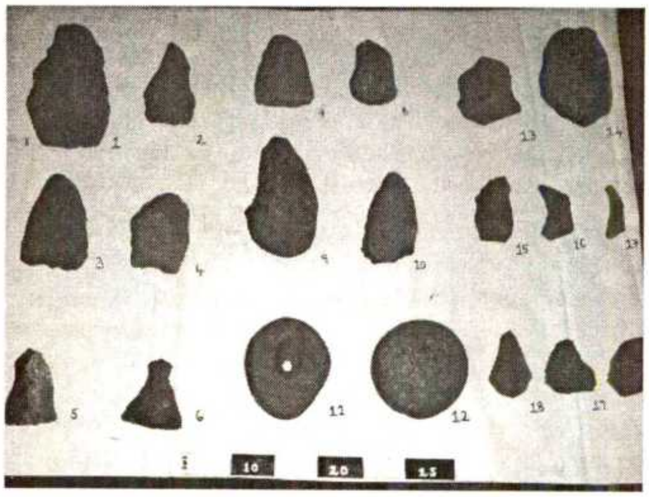

Fig. 21: Surface tools from Neerukalla Ganga (Mekhalabanda settlement)

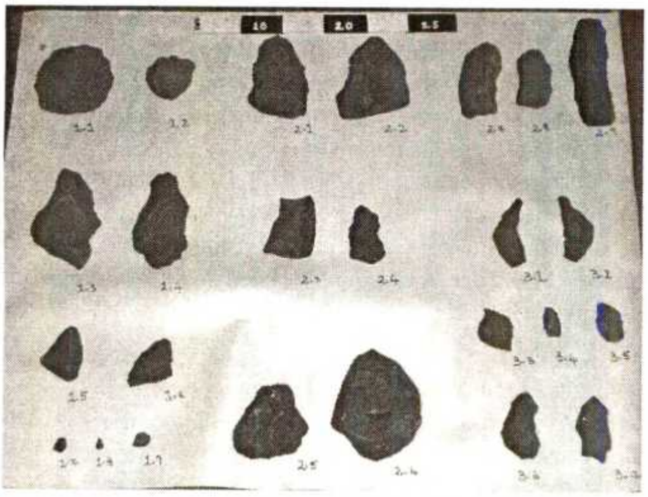

Fig. 22: Surface tools from Mallamma Kaneeru

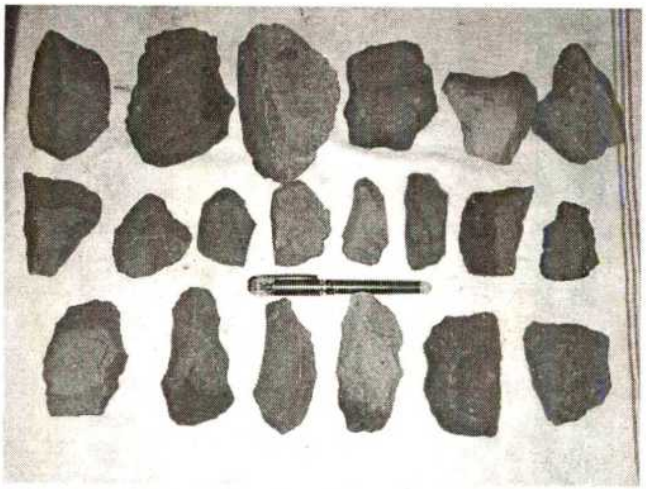

Fig. 23: Surface lithic finds from Peddacheruvu (courtesy: M.L.K. Murthy)

several present-day Chenchu settlements revealed surface scatters of artefacts in Thummalabailu (15° 57' N and 78° 55' E), and Peddacheruvu (15° 58' N and 78° 50' E) (M.I.K. Murthy; personal communication) (Fig. 23), Chintala in the Kurnool and Prakasam Districts and the find spot at the settlement of Gundala (16° 25'-16° 30' E and 78° 5'-78° 6' N) in the Mahboobnagar district. With regard to excavated sites, the Srisailam temple complex site, located 200 m from the temple has Middle to early Upper Palaeolithic tools (Raju *et al.* 1997), and tools were collected from excavations conducted within the premises of the Telugu University, Srisailam. Excavations conducted at the Kadilivanam cave site revealed a high density of tools (Reddy 2001).

Based on the nature of sites and assemblages they can be divided into sites of high concentration; which include sites with water holes, and perennial springs including the temple complex site, Mallamma Kaneeru, Kadilivanam and Gundala. The remaining sites are termed sporadic occurrences, i.e. those sites without a water source. Tools at these sites include cutting tools, choppers, scrapers, knives, mace heads, handaxes, cleavers, borers, burins, blades, flake blades, cores, hammer stones, anvils; etc. Thus, archaeological sites in the Nallamalais and peripheral regions reveal that open air scatters display only lithics with no archaeozoological and palaeobotanical evidence. Nevertheless there is a striking contiguity between habitats of the ethnographic present and of Stone Age sites (Murthy 1985).

Conclusion

The occurrence of several Palaeolithic find spots in the Nallamalais in present day Chenchu occupation zones, and activity loci, implies that Stone Age hunter-gatherer ecosystems continued to support traditional hunter-gatherers. The distribution of these stone tools depending on the nature of the sites (concentrated clusters or sporadic scatters), can be correlated with present ethnographic data on Chenchu settlement patterns. Base camps or the Chenchu permanent settlements have a greater concentration of artefacts due to the longer duration of occupation, while at seasonal and transient camps, artefacts are fewer and scattered. Moreover data on seasonal migrations of the Chenchus, to work camps and temporary dwellings can provide an ethnographic model for the relocation and re-occupation of settlements in the archaeological context.

There is a clear lack of structural remains and vestiges of other minor structures like hearths, floors, post-holes, etc.; in Upper Palaeolithic and Mesolithic sites in the Nallamalai hills, and over most of Andhra Pradesh. Exceptions include an Upper Palaeolithic fire place in the Kurnool caves (Murthy and Thimma Reddy 1976). What initially seemed a drawback to the archaeological and ethnographic correlation of settlement types might just be used to provide the basic evidence for a hypothesis. Chenchus provide testimony to the fact that their original dwellings moved from caves and rock shelters and trees to low grass huts and later circular huts constructed essentially on the '*Banda*' or flat rock terrain. Construction of dwellings on the '*Banda*' involves merely propping up support poles with large stones. In the event of abandonment or destruction of these dwellings all that remains is the circular arrangement of stones, which are reused for other structures. Even in the case of hearths, the traditional three-stone type is prone to easy displacement and other remains are washed away due to the sloping nature of the terrain. It is clear that such methods will not leave marked evidence of post-holes, floors and minor structures in the archaeological context owing to the impermanent building techniques and nature of their terrain. Important for this model is the continuity in the occupation of low grass huts and rock shelters during their seasonal and daily migration to work camps and transient encampments.

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Evidence of Human Occupation from a Terrace dated to 7.8 kyr at Sakshal Pimpri, District Bid, Maharashtra

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Abstract

Crude handmade pottery, animal bones and molluscan shells were found in a ploughed field on the left bank of the river Sindaphana, opposite the village of Sakshal Pimpri. Radiocarbon dating of the molluscs gave an age of 7.8 kyr. The pottery, along with bones and burnt mud is found in the ploughed field, while the shells occur as a discrete heap close to the river. The shells were broken and charred before deposition showing that their accumulation was a result of human action. The pottery is similar to the "Neolithic" pottery reported from Patne by Sali (1996) as well as to early pottery from the Vindhyas described by Pal (1986) as representing "Mesolithic" pottery.

A date of 14.2 kyr. was obtained on shells from a gravel exposed 4 m below the terrace surface. Ostrich eggshell and microliths were found in this gravel. A cobbly-bouldery gravel, resembling high level gravel is found at the base of the alluvial sequence. An exposure of high level gravel is seen 4 m above the Bindusara river, a tributary of the Sindaphana at Namalgaon, 20 km to the east of Sakshal Pimpri. A brief summary of our observations on the Quaternary geology of the area is given here.

Introduction

The Sindaphana River originates near Pathardi, a town which lies to the east of Ahmednagar (Fig. 1). This relatively small river has its main catchment from the northern side of the Balaghat range. Most of the tributaries of the Sindaphana are from the Balaghat escarpment, that is a major divide between the river Manjra, and the Sindaphana. The northern divide is minor, and the tributaries are smaller than those joining from the south. The drainage of this river comes entirely from the semi-arid zone and presently the river appears to be in an aggradational mode. The height of the riverbank rarely exceeds 7 m. Presently the floods overtop the banks and affect modern settlements. This is clear since a number of villages have been shifted due to floods. The most recent occurrence was at Ranjegaon, which was flooded in 1990.

The Site

Sakshal Pimpri village is located on the right bank of the river Sindaphana in Gevarai Taluka, District Bid (Fig. 2). The right bank is bedrock with a shear cliff of 7 m. On the left bank, where the site is located (19° 06' 5" N; 75° 36' 16" E), a 7 m alluvial section is exposed (Fig. 3 and Fig. 4 on inside front cover). Wells dug here show that the alluvium continues below the river level with a total thickness of 15 to 20 m. An older sequence comprising a cobbly gravel overlain by compact silt with calcrete layers is exposed on the bank. This is 3 to 4 m. thick and has a well-developed root cast horizon on the top. Sandy pebbly gravel cuts into this older unit. This gravel is overlain by brownish silt on which a soil has developed. From the sandy pebbly gravel, one ostrich eggshell piece, freshwater shells, an abraded bone fragment and microliths were recovered. A radiocarbon date of 14,200±200 BP (AA2174) was obtained on the shells from this gravel. No artefacts were recovered from the lower unit.

A cross section of the alluvial fill (Fig. 5A), at Sakshal Pimpri, based on exposed and well sections, shows how the bedrock level rises on the northern bank within 500 m of the river so that the river is actually flowing in a narrow bedrock "gorge" which is today filled with alluvium. The basal unit of cobbly gravel is totally anomalous in the context of the present Sindaphana River. At Namalgaon, around 20 km downstream of Sakshal Pimpri, a similar gravel was exposed. It is underlain by around 3-4 m of weathered basalt or "murrum" and can be considered an example of high level gravel (HLG) that is commonly exposed in the Godavari basin (Fig. 5B). Many exposures of HLG are known around Paithan (Joshi *et al.* 1980). The

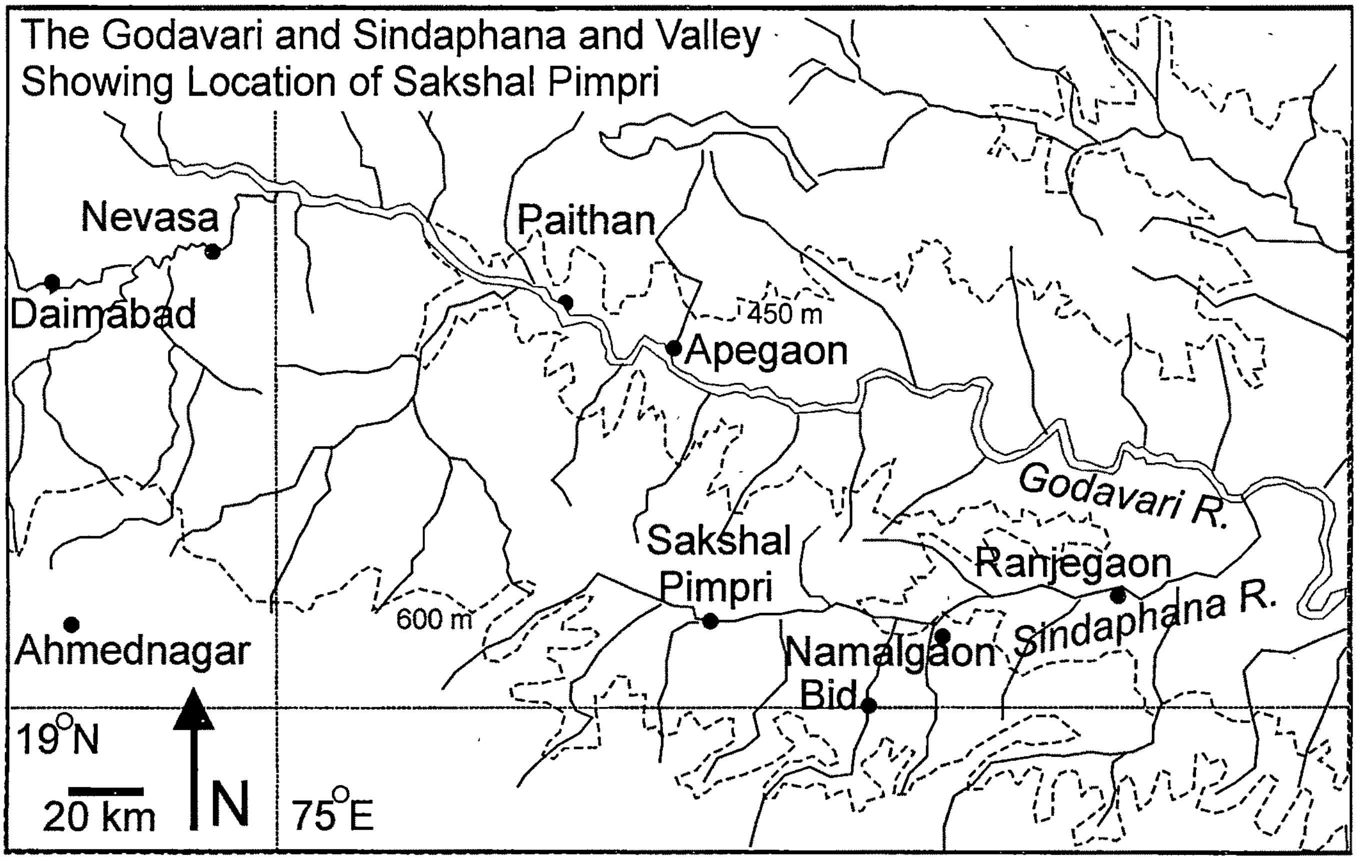

Fig. 1: Map of the Sindaphana basin

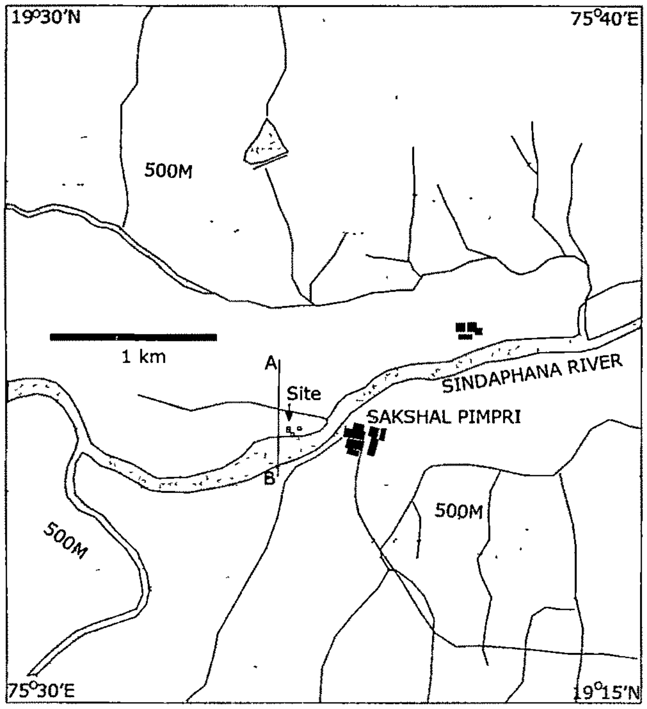

Fig. 2: Location map of Sakshal Pimpri

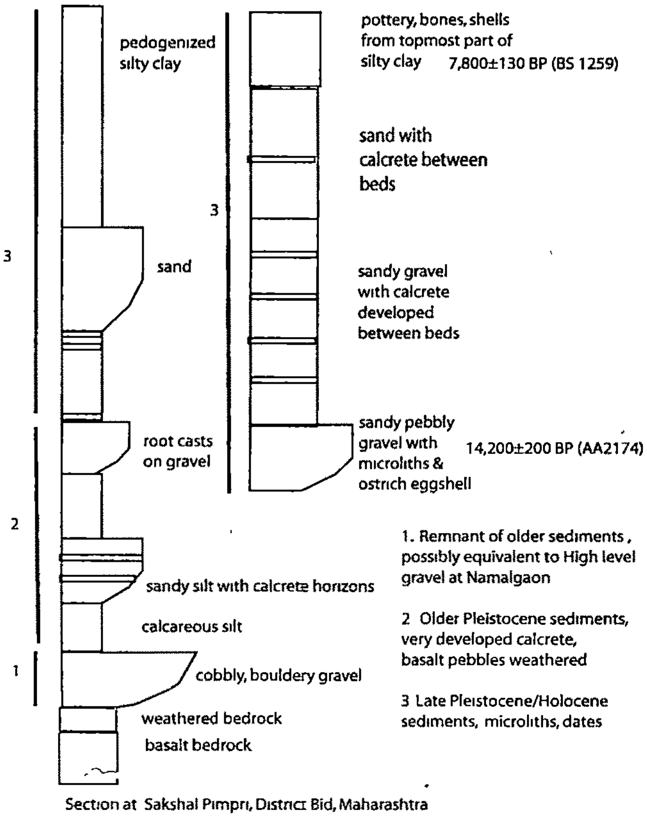
pedogenized silty clay
3
sand
3
root casts on gravel
2
sandy silt with calcrete horizons
calcareous silt
1
cobbly, bouldery gravel
weathered bedrock
basalt bedrock
pottery, bones, shells from topmost part of silty clay 7,800±130 BP (BS 1259)
sand with calcrete between beds
sandy gravel with calcrete developed between beds
sandy pebbly gravel with microliths & ostrich eggshell 14,200±200 BP (AA2174)
1. Remnant of older sediments, possibly equivalent to High level gravel at Namalgaon
2 Older Pleistocene sediments, very developed calcrete, basalt pebbles weathered
3 Late Pleistocene/Holocene sediments, microliths, dates
Section at Sakshal Pimpri, District Bid, Maharashtra

Fig. 3: Quaternary section at Sakshal Pimpri

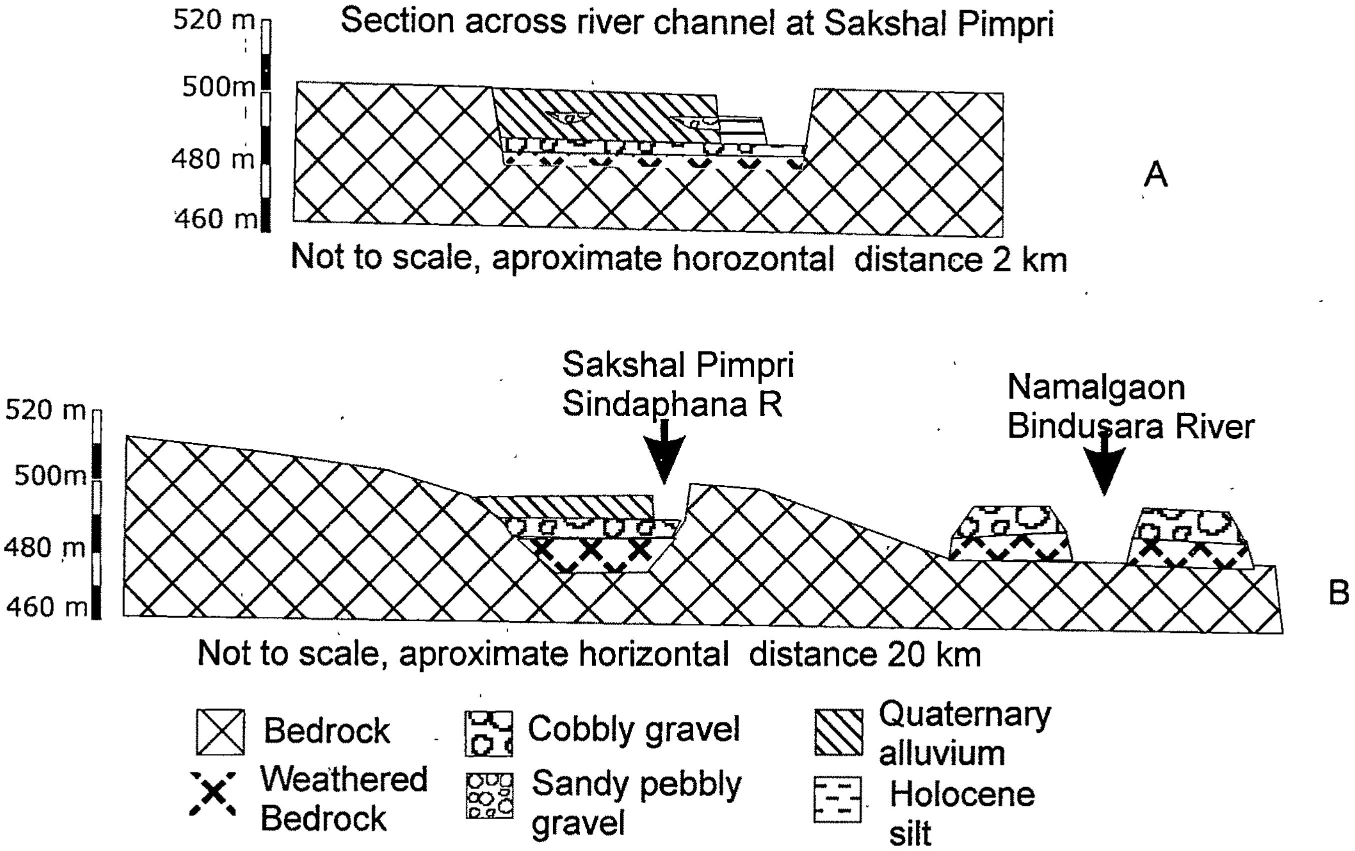

Fig. 5: A Cross section of alluvial fill at Sakshal Pimpri; B High level gravels in Sindaphana basin

difference between the Sindaphana HLG at Namalgaon and Godavari HLG at Paithan is the absence of any siliceous component in the former. Cobble sized agates, and chert are a characteristic of the Godavari HLG at Nevasa, Paithan, Wagoli and Brahmawakdi. The depth of weathered bedrock underlying the HLG in the Sindaphana basin is less than that in the Godavari. Buried alluvium is seen throughout the course of the Sindaphana from Sakshal Pimpri to its confluence with the Godavari at Manjalgaon. These features of buried alluvium, HLG, belong to an earlier phase of the Sindaphana. Absence of artefacts from these units shows that this phase is probably quite old.

The two dates from the exposed alluvium of the terrace bracket an aggradational phase to the period between 14 and 8 kyr. This is in contrast to the dating of aggradation on most of the rivers of Peninsular India to the Late Pleistocene period (Mishra *et al* 1998, 2003; Mishra and Rajaguru 2001). The aggradation of the Godavari river was in the Early Holocene between 8 and 4 kyr which is the period of greatest rainfall according to many palaeoclimatic records. However, the aggradation on the Sindaphana did not occur at the same time as on the Godavari, but preceded it. Thus the terrace surface on the Sindaphana was stable at 7.8 kyr, burying the contemporary temporary camps on the top of the terrace surface. The non-synchronous behaviour of the tributaries and the main streams is also seen in the Bhima basin near Pune. There the aggradation of the main stream (Bhima) was during the arid climate between 26 and 14 kyr, whereas its tributaries like the Vel and Nandi were aggrading between 11 and 7 kyr (Mishra *et al.* 2003).

The ostrich eggshell from Sakshal Pimpri has the youngest date for any ostrich eggshell reported so far. Another date obtained from Khapadkhera site on the Narmada river was 15 kyr (Mishra *et al.* 2003). This may be relevant to the dating of the extinction of the ostrich in India.

The ploughed field on the terrace surface was strewn with bones, shells, microliths and pottery. Shells collected from the terrace surface were dated to 7800±130 BP (BS 1259) whereas shells recovered from the sandy-pebbly gravel were dated to 14,200±200 BP (AA2174). Interestingly enough at Ranjegaon, more than 20 km downstream of Sakshal Pimpri, an identical date of 7800±130 (BS 1256) was found on shells eroding out of the top of the

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terrace surface (Mishra *et al.* 2003). This indicates that the phase of aggradation between 14-8 kyr was widespread in the Sindaphana basin.

To further study the context of the cultural material 4 trenches of 2 x 2 m were taken in 1999. In one field, black soil is seen on the surface and in the other, underlying brown silt is exposed. The pottery was found on the surface of the brown silt, indicating that it may have been exposed after the erosion of the overlying black soil. Trench 1 (TP1) was dug on the western boundary of the field. This is near the boundary between brown silt and black soil. Here, pottery is visible on the surface. This trench yielded microliths, very small abraded potsherds, calcrete nodules and few bone pieces. Trench 2 (TP2) was placed next to the TP 1 on the southern side. This trench yielded mostly burnt lumps of mud, abraded potsherds, a few pieces of bones and microliths. Trench 3 (TP3) was dug on the southern margin of the field where several molluscan shells were exposed. The molluscan shell layer was found below the plough zone. Here shells were in association with microliths and burnt mud but devoid of any potsherds. Below this layer microliths, burnt mud, shells and stones are rare. It was noticed that from a depth of 22-27 cm below from the surface, cultural material diminishes. As compared to TP 1 and TP 2 the soil is sandier. At the depth of 25 cm lumps of burnt mud and shells were collected. The shells had old breaks showing past human activities. The shells occur as a distinct layer in the trench. A potsherd, and a stone tool were also found. Trench 4 (TP 4) is located away from the surface occurrences of potsherds. This trench yielded only a calcrete layer and no cultural material was found.

The cultural material from TP 1 and 2 is in the present plough zone. It is abundant where the overlying black soil has been eroded exposing the brown sediment. However there is no "sealing" layer preserved intact. The presence of burnt mud in addition to the pottery, microliths and animal bones shows that besides the artefacts, hearths and perhaps some temporary structures also could have existed. It is the original location of human activity. TP 3, revealed that shells form a distinct layer slightly below the surface. A shallow irrigation ditch cuts through this layer, being close to the margin of the field, so that the shells initially collected have recently been exposed on the surface.

The Pottery

The pottery at Sakshal Pimpri is very thick and has coarse sand temper. Due to weathering of the surfaces, very few pieces preserve the slip. However, it appears that a very thick slip was applied to the pottery, which was later burnished, and which might have served to disguise the coarseness of the fabric in the finished product..The colours of the slip are red, buff to brownish grey. Only three sherds are of Black-and-Red ware.

Fabric: The clay used for manufacturing the pottery is not well-levigated and has impurities such as calcium carbonate and small rolled basalt granules. Due to this, the potsherds are very coarse and gritty. The grit is river sand and does not appear to have been prepared for use by sieving or pounding, unlike the later practice. The amount of grit added is unusually large and may be one factor limiting the shapes of the pots. The clay is without any organic tempering material.

Surface Treatment: The pottery has undergone abrasion and weathering. This perhaps removed the slip from most sherds. The slip is preserved in a few sherds, indicating that they have been burnished. Some of the sherds have preserved thick slips on the inner and outer surfaces. The slips are blotchy and come off easily.

Pottery types: The pottery assemblage is very fragmentary and has very few rim sherds. Thus it is very difficult to understand the shapes and the sizes of the pots. The few rim sherds that are preserved, belong to bowls. The bowls are shallow, having straight or slightly convex sides with featureless, incurved rims.

Decorations: The pots have incised decorations on the bowl rims. These incised decorations are deep and were not obliterated even on abraded potsherds. The decorations comprise oblique lines forming a fish bone pattern.

The pottery from this site is handmade and thick. The thickness of the sherds was measured and is shown in Fig. 6. The modal value for sherds was between 12-16 mm.

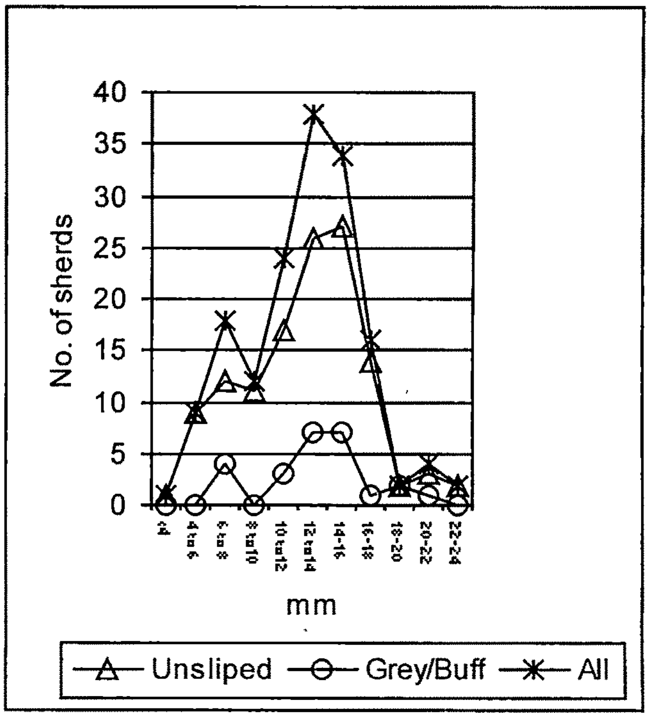

Fig. 6: Graph showing thickness of pottery sherds

There is a broad range of thickness from less than 4 mm to 22-24 mm. A secondary mode is found between 6-8 mm thickness (Fig. 6). While most sherds are thick the few thinner sherds may belong to a different type of pot, which are less well-preserved. Rim sherds are of open vessel types with some incised decoration (Fig. 7, please see inside front cover). Coarse sand was used as a temper and a thick slip was applied which has been removed by abrasion. In this feature the pottery resembles that of the Ramtirth ware at Apegaon which is only around 20 km to the NE of Sakshal Pimpri. This is the earliest pottery in the Godavari basin, which has been dated to 3.5 kyr at both Apegaon and Daimabad. Also it is similar to the pottery reported by Sali (1996) from Patne which he places stratigraphically between the Mesolithic and the Chalcolithic.

Pal (1986) describes what he calls "Mesolithic" pottery from the Vindhyan rock shelters. In the excavations of rock shelters a stratigraphic sequence of pottery could be found. According to him the earliest pottery has incised decorations, of oblique lines, which are so deeply incised that they were not abraded subsequently. The cord impressed ware follows the incised pottery and is succeeded by the and the regular Chalcolithic pottery. The pottery from Sakshal Pimpri, therefore, closely resembles the "Mesolithic" pottery described by Pal (1996). Although The stratigraphic position enables him to call it Mesolithic, although he has no dates, while at Sakshal Pimpri we have dates but poor stratigraphic control.

Stone Tools

Stone tools were found both in the shell layer as well as on the surface of the field and in the trenches. The assemblage is not large (224 pieces) but includes blades and blade cores as well as the waste products from microlith manufacture (Table 1). A number of types of micro-blade cores are found. The most distinctive are wide with one face prepared for removal of microliths. Besides these cores, cylindrical microlith cores are also found. Core rejuvenation flakes and a few retouched flakes complete the stone tool assemblage.

Reconstructing the reduction sequence from observation of the assemblage has been attempted. Raw material nodules are mostly chalcedony and chert obtained from rock outcrops and not river pebbles. Greenish chert appears to be the favoured raw material (Fig. 8, please see inside front cover) and two retouched flake tools and one very large trimmed nodule were made on this raw material. The most common material is white chalcedony. There is a very large range in size of the cores (Table 2). Some of the smaller cores may be more highly reduced. The largest is the green chert trimmed nodule and the smallest a very intensively worked white chalcedony core.

The cores are well standardised. Raw material nodules were trimmed for blade production by forming a guiding ridge on one side and removing the cortex from the striking platform. After a number of microliths are removed, further preparation is required. The cortex flakes are the flakes produced in the initial trimming of the

Table 1: Microlithic assemblage from Sakshal Pimpri

Cores		**Flakes**		**Blades**	
Raw material nodules	5	Cortex flakes	13	Backed blade	0
Trimmed nodules	15	Flakes	58	Backed blade fragments	1
Cores	13	Flake fragments	14	Blades	7
Core fragments	1	Core rejuvenation flakes	4	Blade fragment	2
		Chunks	38		

Table 2: Length of the stone tools (mm)

						Frequency					
Range	**0-5**	**5-10**	**10-15**	**15-20**	**20-25**	**25-30**	**35-40**	**40-45**	**45-50**	**>50**	
Core	20-82	0	0	0	0	3	4	3	2	0	1
Chunk	16-50	0	0	0	9	11	4	5	3	3	1
Flake	3-38	1	6	16	16	12	5	6	2	0	0
Cortex flake	12-41	0	0	1	2	2	2	4	1	0	0

nodules while the non-cortical flakes are involved in the later re-trimming of the core to continue blade production. The large numbers of "chunks" are also part of the core trimming by-products. The finished products are quite rare with only a single backed blade fragment and two retouched flakes. Even the microliths are few in number. The large amount of debitage to finished material is part of the sophisticated technology where preparation of the core is elaborate and cores are repeatedly re-trimmed to produce more blades. The large size range of the cores reflects the large amount of reduction made on cores (Table 2).

Faunal Remains

A total of 120 fragments of animal bones weighing 533 g were examined, of which 39 were identifiable. The collection has 81 unidentified fragments. A majority of these fragments were small (<1 g). It is interesting to note that large fragments (more than 3-5 cm) are absent.

The surface of most fragments show vertical as well as horizontal cracks. This feature indicates that these bones were perhaps exposed for some time before getting buried. However, there are no marks of trampling by animals and the edges of the bones are not rolled/damaged due to movement of any sort. Only two fragments (one metapodium and one calacaneum) bear marks of chewing by a carnivore. A couple of bone fragments showed ancient cut/breakage marks. In most cases the cut edges are intact.

This small faunal assemblage revealed the presence of domestic mammals such as *Bos indicus* (cattle), *Bubalus bubalis* (buffalo), and *Capra/ Ovis* (Goat/Sheep). Although bone measurements are not available, cattle at Sakshal Pimpri were of the medium-heavy variety. Cattle of all age groups have been identified. Two very old animals (age more than 10-12 years) has been identified based on the wear pattern of their teeth. Buffalo has been identified from two trenches . One calcaneum bone is of large size. It may represent wild buffalo (*Bubalus arnee*). However, in the absence of bone measurements, it is not possible to confirm its wild status.

A few fragments of a small ruminant have been noticed. It was not possible to identify these as of goat or sheep, although most probably they represent goats. Besides domestic mammals, a species of deer (*Cervus* sp.) has been noticed. Due to the fragmentary nature of the bones it is not possible to identify it either as Barasingha or Sambar.

The assemblage has both meat and non-meat bearing components of skeletal elements. Portions of pelvis, ribs and vertebrae, which contain more meat, are almost absent. The general condition of the fragments indicates that animals were utilized to the full extent and marrow was perhaps also extracted. Therefore, we see very small fragments and splinters that are produced during butchering, cutting and consuming the marrow portion. This collection has one bone tool made from the distal portion of cattle/buffalo humerus. It is like a point or an arrowhead and its point shows marks of polishing/sharpening.

Fluorine Phosphate Ratios of Bones

Two horizons for bones are present at Sakshal Pimpri- the sandy pebbly gravel and the silty clay (Fig. 3). The sandy pebbly gravel within the terrace fill yielded a small bone fragment. This is associated with a C-14 date of 14.2 kyr. The silty clay horizon where 4 trenches were dug is associated with a ^{14}C date of 7.8 kyr. Therefore, the comparison of the fluorine phosphate ratios from the two contexts is possible and can help in evaluating alternative hypotheses for the age of the surface bone assemblage. The bones either are the same age as the shells dated to 7.8 kyr, or they belong to the Chalcolithic period (since the pottery is associated with microliths) around 2.8-3.5 kyr. A large number of bones from the Chalcolithic have been previously analyzed (Kshirsagar 1993). It was found that there is very little enrichment of fluorine in bones of the Jorwe period, and that different phases of the Chalcolithic could not be differentiated by their fluorine phosphate ratios. Interestingly enough, the bone from the lower horizons, is dated to 14.2 kyr is 3.30 while that from the surface is 3.94. From Ranjegaon, where shells gave the same radiocarbon date as Sakshal Pimpri, a bone gave a fluorine value of 3.06. A bone from the Chalcolithic site of Sashtewadi, near Pune gave a fluorine value of 0.124. The values from Sakshal Pimpri and Ranjegaon are too high to be of the Chalcolithic. Therefore, the fluorine values of the bones support an older date and the association of the bone and pottery assemblages with the shells.

Freshwater Shells

The shells recovered from TP 3 mainly comprise freshwater bivalves along with a few terrestrial gastropod shells. Both fragmented and complete bivalve shells are present. These are chalky-white in colour. The external surface shows flaking to expose the nacreous layer below. Growth lines are clearly visible on the surface and shell breakage has occurred along these lines. The umbonal part of the shells appears to be better preserved. Shell fragmentation has occurred both due to post-depositional factors as well as past human activity. Ploughing in the black cotton soil has disturbed the deposit, displaced the shells and brought them to the surface. Some fragments show signs of old breakage along their edges. Besides fragmentation they have also undergone certain a degree of shell dissolution.

The shell assemblage is mainly composed of the freshwater bivalve *Parreysia flavidens*. Only three terrestrial gastropod shells are present which could not be identified upto the species level. *Parreysia flavidens* is an equilateral, thick angulate sturdy shell with a nacreous periostracum. The cardinal teeth are strong and broad. The shells of the Genus *Parreysia* commonly occur in majority of the Indian rivers, streams and lakes. Today in parts of Eastern India, *Parreysia* sp. are regularly used as a food resource (Subba Rao 1989). Evidence for their exploitation in the past has been obtained from some of the Chalcolithic/Neolithic, and the Iron Age to the Early Historic sites in Peninsular India (Deshpande-Mukherjee 2005). Charring was observed on three fragments along with a few burnt lumps of clay in the shell bed. The presence of fairly large-sized shells and charred fragments is indicative of subsistence related activities in the past. These probably represent a shell dump which has resulted from the accumulation of the discarded shells of *Parreysia* brought to the site as food from, the nearby river. The sizes of the shells indicate that good quality shells were collected from a sluggish river. Generally bivalves from lakes and slow streams are larger than those from the rapid rivers. Absence of a perforation, grinding of the edges, etc. suggests that the shells were not used for manufacturing ornaments or any other objects.

In the case of the terrestrial gastropods these may not have been deliberately collected like the *Parreysia* came into the deposits due to natural factors.

Discussion

The different categories of evidence, pottery, microliths, bones and shells are indicative of human activity at the spot. Shells occur as a discrete layer confined to a small area of 10 m along the riverbank. The analysis of the shells shows that they were collected, processed for extraction of their meat and discarded in a heap. Independent support for the age of the pottery/bone/microlith assemblage comes from the fluorine values of the bones which is much greater than that reported for any bones associated with any Chalcolithic assemblage. The pottery cannot be younger than the Chalcolithic period, both typologically and owing to their association with microliths. The crudeness of the pottery and it resemblance to the earliest pottery reported from Vindhyan rock shelters and Sali's "Neolithic" pottery from Patne also support the early date.

The main objection to age of the pottery being 7.8 kyr is that there are no other sites where pottery in India has been assigned such an early date. The earliest permanent settlements in the Godavari valley, at Daimabad and Apegaon, date to only 3.5 kyr, less than half the age of the Sakshal Pimpri date. The identical date for the earliest phase, Savalda/Ramthirth at both the sites shows that this may be a significant event. We would like to suggest that 3.5 kyr is the date for the beginning of permanent settlements in the Godavari, and pottery may have been used earlier in the context of a more mobile subsistence pattern. Pottery is preserved in the buried context and becomes visible to the archaeologist after the appearance of accumulations of habitation debris abundant enough to create a deposit. The Sakshal Pimpri pottery is not preserved in the matrix of a habitation deposit, but rather within the upper part of the terrace alluvium. It was a temporary settlement covered with a thin flood deposit and presently exposed by the disturbance of the covering silt and soil by ploughing.

A date of 7.8 kyr for pottery is not by itself impossible. In eastern Asia pottery is now known from almost 13 kyr and some of the early pottery comes from the Amur valley in a pre agricultural context (Kuzmin *et al* 2001; Keally *et al.* 2004). Perhaps more relevant is the fact that pottery appears in the Neolithic of West Asia in the beginning of the 6th millennium B.C. or around 8 kyr. Mehargarh, closer to the Indian Subcontinent, has pottery from this period (Jarrige 1984). In Gujarat and Rajasthan, sites such as Nageshwar and Balathal now have an "Early Chalcolithic" phase dating to 6 kyr (Misra 2005). The sand dune site of Bagor also has early pottery dates. The site of Lauradeva in the Ganga valley has given a date of 7 kyr (Tewari *et al.* 2003). Therefore, although this date is unexpected for pottery in the Godavari valley, it need not be dismissed as "impossible". We do admit that we could not eliminate the possibility that the shells date to an earlier occupational episode compared to the pottery, but in considering all the evidence we think there is a strong possibility that the pottery from Sakshal Pimpri does date to 7.8 kyr.

Acknowledgements

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Excavations at Sisupalgarh 2005

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Abstract

The walled city of Sisupalgarh presents an ideal opportunity to examine the growth and development of urbanism in the Early Historic period(c. 3rd. Century B.C. to 4th. Century A.D.). Excavations in 2005 have concentrated on two areas of the site:- the habitation area within the walls, and the upper portion of the rampart wall. Excavations within the habitation area were undertaken to provide information on domestic architecture within the fortification walls; and to expose further the area of the architectural remains recovered in the 1948 excavation. To provide new material for chronological dating, a small trench in the habitation was also dug to the level of natural soil, with over 5 m of cultural deposits, including well-preserved faunal and botanical remains. Excavations at the top of the rampart revealed a stone and brick wall at the crest along with a considerable volume of pottery indicative of the use of settlement debris for the uppermost reconstruction of the city's encircling rampart.

Introduction

Sisupalgarh, an urban centre of the Early Historic period, is located on the southeastern edge of Bhubaneswar in eastern India. The site measures 130 ha in size and is enclosed by an impressive rampart-and-moat configuration that is 9 m in height and over 1 km in length on all sides. Other prominent features include a set of 14 monumental laterite columns and numerous stone-lined reservoirs within the rampart area. Sisupalgarh's hinterland has other indicators of a diverse urban habitation, with significant cultural deposits to the north and west of the rampart. In addition, the site is located within 10 km of the Asokan inscription at Dhauli as well as a first-century B.C. inscription by Kharavela at the cave site of Khandagiri-Udayagiri.

The site of Sisupalgarh was first excavated by Prof. B.B. Lal in 1948 (1949; 1991). The goal of our excavations in 2005 was to evaluate the socio-economic development of the urban centre by examining households and domestic assemblages*. In addition to building on the results of earlier investigations utilizing currently available technology, the present excavation project also carries forward the systematic survey and mapping program carried out at Sisupalgarh from 2000-2003 (Smith 2002a, 2002b, 2003, 2005).

The upper deposits are of the Early Historic period and are covered with a thin overlay of alluvium and wind-borne material. This is in contrast to other early South Asian cities, such as those in the Ganga plains, which have many occupational layers resting over Early Historic levels. Our goal is to excavate domestic structures and use artefactual, architectural, faunal, and botanical data to evaluate how households were organized; and how they participated in successively larger social configurations including neighborhood and urban-level arrangements during the Early Historic period.

Methodology

From January to February 2005, our team undertook horizontal excavations at two places — within the rampart walls on the western side of the site in an area of domestic architecture (Operation 1), and on top of the rampart in the northeastern corner of the site (Operation 2). In addition, there was a single deep sounding to natural soil in the western portion of the site (Core Sequence 1; Fig. 1).

For the horizontal exposures in Operations 1 and 2 we utilized an open excavation area without baulks, in which the area was divided trench-wise. Each trench received a letter designate and was no larger than 5 x 5 m in size. Recording of excavated material was undertaken using a

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* The excavations were jointly conducted by Dr. R.K Mohanty of Deccan College (India) and Dr. Monica L. Smith (USA) under a permit from the Government of India through the Archaeological Survey of India.

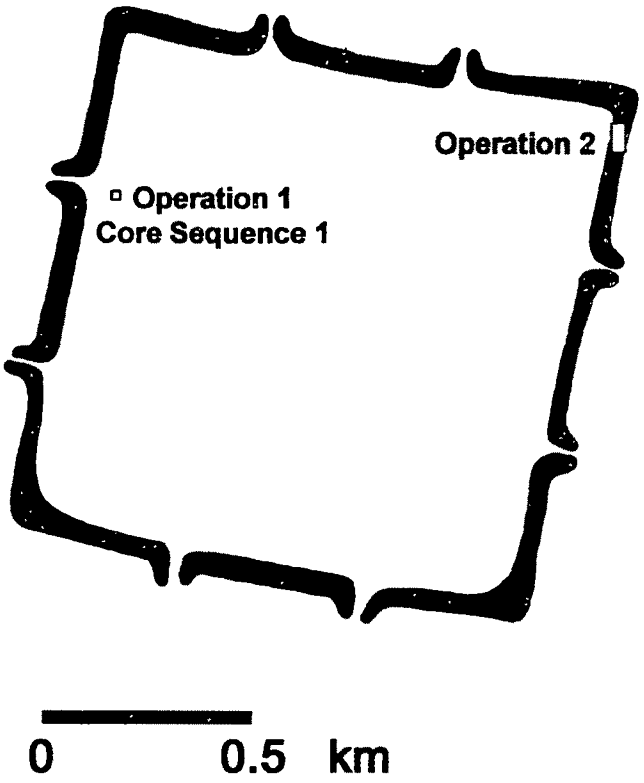

Fig. 1: Location of the excavated areas within the fortification

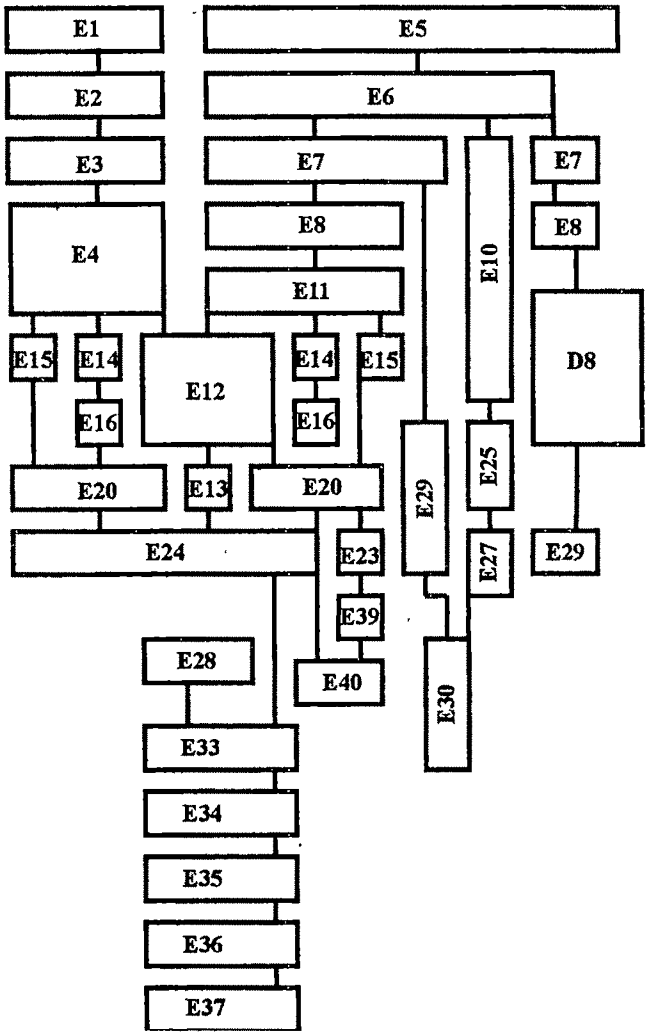

Fig. 2: Correlation of mini-matrix of Trench E, Operation 1

locus system in which each arbitrary unit or integral stratigraphic unit (e.g. change of fill or a feature such as a wall or pit) was given a number and recorded on a separate standardized recording form. Locus numbers were given in numerical sequence per trench starting with the numeral 1, and each excavator noted the relationship among loci through a Harris matrix diagram completed on each locus sheet and on a master sheet for the trench as a whole (Fig. 2). During the course of the excavation, pottery and other artefacts were collected by hand and placed in polythene bags with tags noting the date and locus number. A recording form was filled out for each locus that described the beginning and ending depths, amount and types of artefacts recovered (including weights of pottery), and a sketch map of the excavated area showing features and structures revealed after the removal of each locus. Depth measurements were taken with a centimeter tape and line level, in which the string with the line level was attached to the nearest trench corner. This method was simple yet effective, and could be consistently achieved by each person working in the trench. Each trench supervisor also completed a one-page summary report of the trench at the end of the field season and at the end of the season, detailed architectural plans were drawn to scale on graph paper to show the relationship of architectural elements throughout the trench.

Operation 1: Extension of the 1948 excavation on the western side of the site

Operation 1 was an 8 x 10 m trench immediately west of the 1948 excavations (Fig. 3). Our specific research questions included the types of activities carried out within structures and the comparison of architecture with materials recovered from surface collections of 2001-03. Our excavations in Operation 1 terminated at 1 m below the modern ground surface, roughly at the same elevation as the exposed architecture from the 1948 excavations.

The uppermost architectural elements of Operation I were located in the top 40 centimeters of the excavation and consisted of irregularly shaped laterite blocks with measurements ranging from 30 x 40 cm to 60 x 110 cm. In some cases a layer of bricks was preserved on top of the laterite (Fig. 4). There were also brick features such as walls, usually of one to two courses; a single layer of

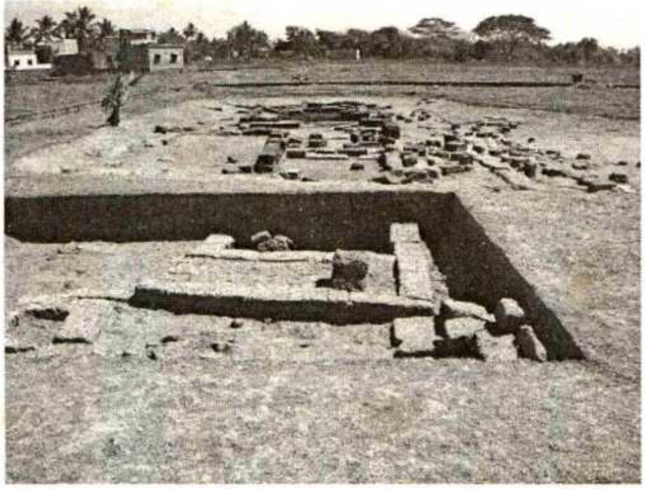

Fig. 3: Trench excavated in 2005, (in the background the 1948 excavated areas can be seen)

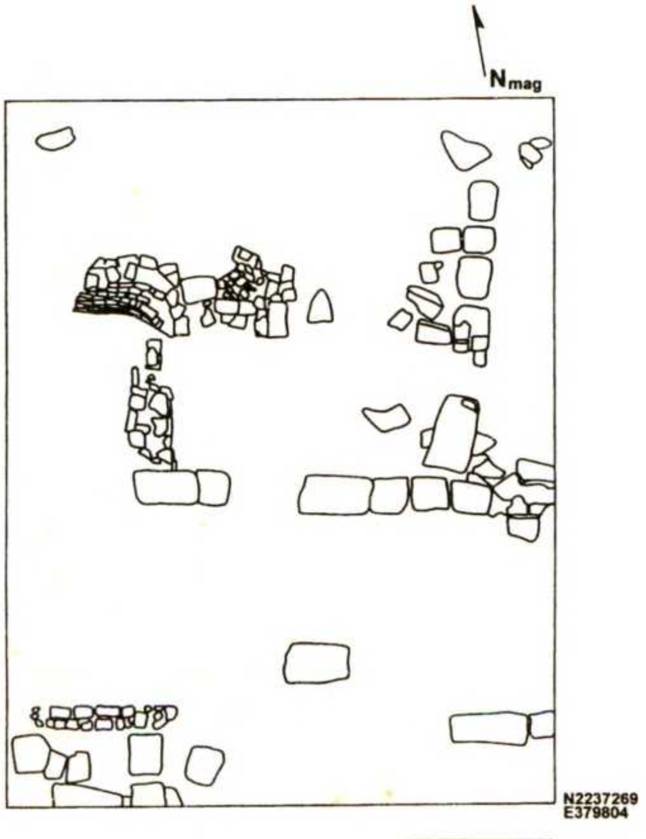

Fig. 4: Remains of brick and lateritic structures, Phase I

bricks in a "step"; and a feature made of flattened tiles. All bricks and tiles used in these features were reused materials and of irregular size; with no complete bricks or tiles recovered. Moreover, the bricks appear to have been made of reused materials. Those encountered in the fill of the area had sherds, laterite gravel and other inclusions suggesting that the brick-makers made use of cultural deposits rather than using pristine clay. The thickness of the bricks ranged from 7 cm to 9 cm.

Further excavations in Operation 1 revealed what we have labeled "upper minus one" phase architecture (Fig. 5). This architecture, which resembles the exposed 1948 architecture in style and configuration, consists of well-shaped laterite blocks carefully arranged into rectilinear structures. There was one structure consisting of two rooms in the southeast corner of the excavation, in which the complete room had internal dimensions of 3.2 x 1.95 m. There was also a series of steps belonging to a second structure at the far southwestern edge of the excavation. The architecture of the "upper minus one" phase was found preserved from around 50 cm to 1 m below the modern ground surface. For the most part, this architecture was in the same orientation as the upper phase structures, indicating that it may have been a reconstruction on the

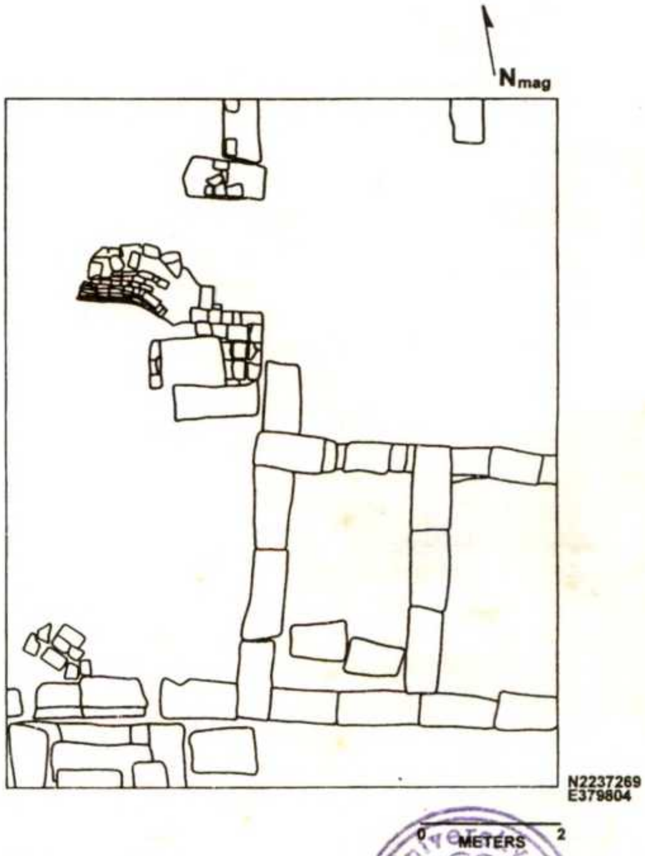

Fig. 5: Lateritic House structure, Phase II

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same alignment. Although we initially thought that the two architectural phases represented courses interspersed with mud filling, the presence of intervening features, such as an area of flattened tiles between the walls, suggests that there were different uses of the area between structural phases.

Although we had anticipated that Operation 1 would contain the interior of a domestic structure on the basis of the orientation of the adjacent street found in the 1948 excavations, it seems that most of it represents an area "outside" two structures. This was on the basis of the following observations; the large amount of pottery throughout the northwest portion of the Operation 1 excavation area; the ephemeral brick architecture consisting of single-course walls and the area of flattened tiles; a *chula*-like (hearth) feature west of the two southeastern rooms; and the presence of several kilograms of discarded crucibles scattered in the fill of the northwestern portion of the trench. The presence of shallow cuts in laterite blocks of the walls and steps, appear to be drains leading from the interior of structures into an open area of discard and multiple outdoor uses in the northwestern portion of the trench. While this architectural phase was in use, the inhabitants also installed a single layer of bricks as a "step" leading down from the laterite blocks towards the north, perhaps to build up an area over the mud courtyard. In the very last (uppermost) phase of the site's occupation, one poorly-built north-south laterite wall was constructed, perhaps to further subdivide the outside area.

One remarkable aspect of the Operation 1 excavations was the very high density of pottery, particularly in the northwestern portion of the trench where an individual locus (typically measuring 5 x 5 x 0.10 m depth) might contain up to 80 kg of pottery. While there was legitimate concern given the proximity of the 1948 trench that we were encountering a sherd dump from the previous excavations, three observations confirmed that Operation 1 represented intact deposits. The sections of the trench did not show disturbed deposits; intact architecture was present in association with the sherd deposits in our trench indicating that there had been no disturbance in the area prior to our excavations; and there were sherds of Rouletted Ware in the upper levels of Operation 1. Since this ware received emphasis in the previous excavations it is highly unlikely that any fragments would have been discarded. A final confirmation of the integrity of the deposits in Operation 1 was provided by the present year's excavation in the northern portion of the site, where the deposits of ceramics in the upper levels were in some cases even greater than what was encountered in Operation 1.

Operation 2: Top of the rampart on the eastern side

The rampart on the eastern side of the site was chosen for a limited investigation to provide data from a portion of the site that was previously not excavated. Further intensive surface mapping of the rampart in 2003 recorded the presence of a number of brick and stone fragments. In order to confirm whether these fragments represented purposeful architecture or displaced fill, we excavated two small trenches at the top of the eastern rampart just south of the northeast corner. The first trench, C, revealed that the bricks noted on the surface belong to a wall having at least seven preserved courses (Fig. 6). Another 5 x 5 m scraping, labeled trench A, was carried out closer to the rampart corner and 100 m north of trench C. Trench A was scraped to a depth of 2-5 cm revealing several laterite blocks.

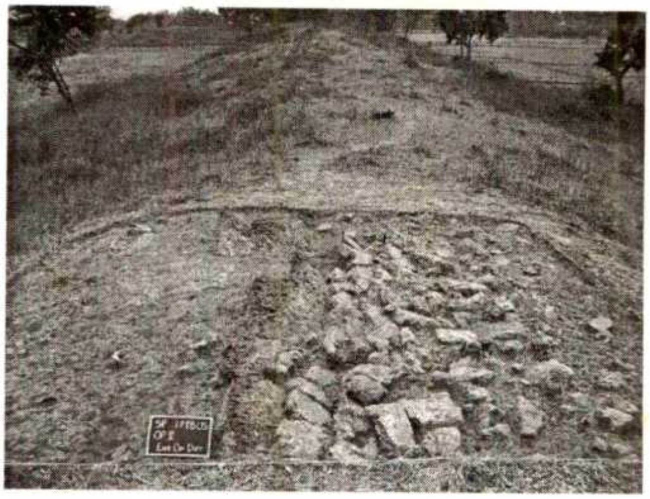

Fig. 6: Structural remains on the top of the rampart, Operation 2

Operation 2 had a very high quantity of ceramics with densities per cubic meter comparable to the Operation 1 excavation. This indicates that the materials used in the rampart were augmented by fill from domestic areas (rather than a continual heaping-up of relatively sterile material dredged out from the moat, for example). These ceramics were also of large size (up to 10 cm), indicating that they had not been extensively displaced and worn prior to their deposition on top of the rampart. The range of wares and forms was identical to the materials recovered in the surface survey and on the western portion of the site in Operation 1. In trench A, we recovered a piece of "knobbed" ware made of a red sandy fabric, which contrasts with the gray fabric that comprises the bulk of this ware elsewhere in the site.

Core Sequence 1: Deep sounding on western side

The goal of the deep sounding was to reach natural soil in the vicinity of Operation 1 to investigate the site's chronology and to provide a comparative sample of pottery and other materials. It should be noted that Prof. Lal's 1948 deep sounding was carried out directly under the rampart as a continuation of the "Trench across the Defences". The 2005 core sequence was laid out as a 1.5 x 1.5 m square trench in the far southeastern corner of the area bounded by the wall around the 1948 excavations (Fig. 1). The trench was excavated in 30 cm arbitrary units. Within each 30 cm unit, all ceramics and other materials were recovered along with a 20 L soil sample for flotation and a 200 g soil sample for the recovery of phytoliths. At 2.10 m below modern ground surface, water began seeping into the trench due to the high modern water table in the area, which was pumped out continuously. Underlying deposits were screened using water and a 2 or 5 mm mesh. A total of nineteen 30 cm units were removed from the trench. Despite the waterlogged conditions, faunal and botanical remains including animal bones and charred grains were in a good state of preservation and are now being analyzed at the Deccan College. The core sequence terminated with an archaeologically sterile dense grey clay at 5.8 m below the modern ground surface.

Pottery and Small Finds

The principal aim of the ceramic sorting were to record the shapes of vessels as well as wares (indicative of manufacturing types). This would enable us to identify domestic consumption patterns and economic activities related to the production and distribution of vessels for cooking, storage and serving. Diagnostic and decorated sherds were recorded in detail to recover information on labour investment and vessel shape and size. The pottery from Operation 1 excavations is consistent with the material recovered throughout the site during the 2000-2003 surface survey within the rampart walls and the 1948 excavations. Small finds in Operation 1 included two metal coins (cannot be read) and a small number of stone beads and metal artefacts. The majority of finds consisted of terracotta ornaments such as pendants, beads and bangles.

Interpretation

The 2005 excavations in the western portion of the site revealed that domestic architecture in the uppermost occupational phases consisted of mixed brick and stone architecture of varying quality, with modest room sizes. The long sequence of cultural deposits from the core sequence shows that there are two principal phases of material activity represented in the western portion of the site. The first half of the site's occupation is characterized by pottery with a high quantity of labour investment in burnishing and firing, along with significant deposits of faunal material as seen in the deep sounding of the core sequence. By contrast, the upper phases are characterized by low-fired pottery, distinctive but rapidly executed pottery decorations, terracotta ornaments, appearance of crucibles and introduction of roof tiles. This phase is represented by the upper 2 m of deposits at the site, suggesting a long phase of occupation under these changed economic conditions.

The excavations at the top of the rampart in Operation 2 showed that this was continuously maintained throughout the site's occupation, since the brick and stone wall at the crest of the rampart was augmented by deposits of pottery and other artefacts. This widespread occupational deposit indicates that the city was fully occupied at the end of its life and did not suffer from a slow decline. In addition, the civic infrastructure of the ramparts was maintained until the end of the site's occupation, signaling a conscious upkeep of the urban infrastructure.

Further excavations planned at Sisupalgarh in 2006 will be undertaken to expand on the results of the 2005 season. In addition, evaluation of the botanical and faunal remains as well as stone resources is ongoing, as is the absolute dating of the site's occupational layers.

Conclusions

The 2005 excavations of the rampart and domestic habitations at Sisupalgarh enabled us to reach the following three conclusions:

(1) While there is a suggestion of "urban planning" in the very regular outline of the ramparts, we found what appears to be an irregular and idiosyncratic layout of domestic habitations within the site. In other words, centralized dictates about lived-in spaces might have been effective only in some aspects of city life, and may have devolved to local control at the level of the local neighborhood and household.

(2) Excavations on the ramparts showed that there were augmentations of the rampart throughout the period of the site's occupation, which may have been linked to neighborhood or district management rather than the centralized planning of routine maintenance.

(3) Deep excavations showed that the uppermost remains throughout the site were of the same time period, meaning that the city was fully inhabited until the end of the site's occupation. We do not know why the city was abandoned in a relatively short period of time, but it may involve as yet unidentified factors of disease, environmental change or warfare.

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Excavations at Bokhira (Porbandar) on the Saurashtra Coast

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Abstract

Excavations at Bokhira (Porbandar) on the Saurashtra coast revealed a Protohistoric settlement dating back to the mid 3rd millennium B.C. Four trenches were laid in agricultural land where a habitational deposit of 50 cm was noticed. A large quantity of pottery, animal bones and other antiquities similar to those reported from Bet Dwarka, Rojdi and Rangpur were found at the site. The place being close to a creek must have been suitable for maritime activities and would have served as a safe harbour. A few ancient jetties have been reported earlier along the Porbandar creek.

Introduction

With the exception of the Okhamandal region, the southwestern coast of Saurashtra has not been studied in detail from the archaeological point of view. However, recent explorations suggest that the Saurashtra coast has played a key role in development of human civilization in the Indian Subcontinent. Harappans were the first to establish their colonies at Nageshwar (Hegde *et al.* 1990), Prabhas Patan (Sankalia 1974), Padri (Shinde 1992) and Lothal (Rao 1979) on the Saurashtra coast. Extensive archaeological excavations indicate that most of these sites were engaged in maritime activities in the past. Several Late Harappan sites have also been noticed on this coast. During the historical period, several ports were active, which find mention in Indian and foreign accounts. These include Dwarka (Gaur *et al.* 2004), Bet Dwarka, Porbandar (Gaur *et al.* 2004a), Prabhas Patan, and Hatab (Pramanik 2004) amongst others. These finds prompted us to look for similar sites on the Saurashtra peninsula, in particular along the coast. Explorations were conducted in November 2004 along the southwestern coast of the Saurashtra, as a result of which a site was located on the western side of the Porbandar Creek (Fig. 1). It is presently under cultivation. There is a well-defined depression around the site towards the creek, which is presently flanked by a high metal road. According to local traditions, there was a *Juna Dhakka* (ancient jetty), which indicates that the site was very close to a jetty site in the past. The location of the study area clearly favours the utilisation of the creek for maritime activities around Porbandar.

Results

Four locations were selected for excavations to assess the settlement extension and total cultural deposit. Three of them were laid on the eastern side of an ice factory, while the fourth was laid on the southwestern side of the factory. The details of each site are given below.

Trench 1

The trench is located in the middle of an agriculture field and measures 5 x 5 m. A total habitational deposit of 62 cm was excavated. Habitation took place on the natural limestone bedrock, which slopes to the east. Two postholes were noticed on this bedrock (Fig. 2) having diameters of 30 cm and 20 cm and depths of 25 cm and 15 cm respectively. A disturbed structure was exposed on the eastern corner of the trench with a total length of 2.5 m and width of 50 cm (Fig. 3). Only one course survives. The structure is oriented north-south and is made of small irregular limestone blocks. A large quantity of Late Harappan pottery was noticed in the entire sequence. Important shapes include convex sided bowls, dishes and jars. A few potshards have paintings on the exterior.

Trench 2

A trench measuring 2.5 x 2.5 m was laid to the northeast of Trench 1. A habitational deposit was noticed up to a depth of 48 cm. A disturbed structure was also observed on the southern section. As in Trench 1, habitation took place on the bedrock, which was also used as working floor. Pottery is similar to that reported in Trench 1.

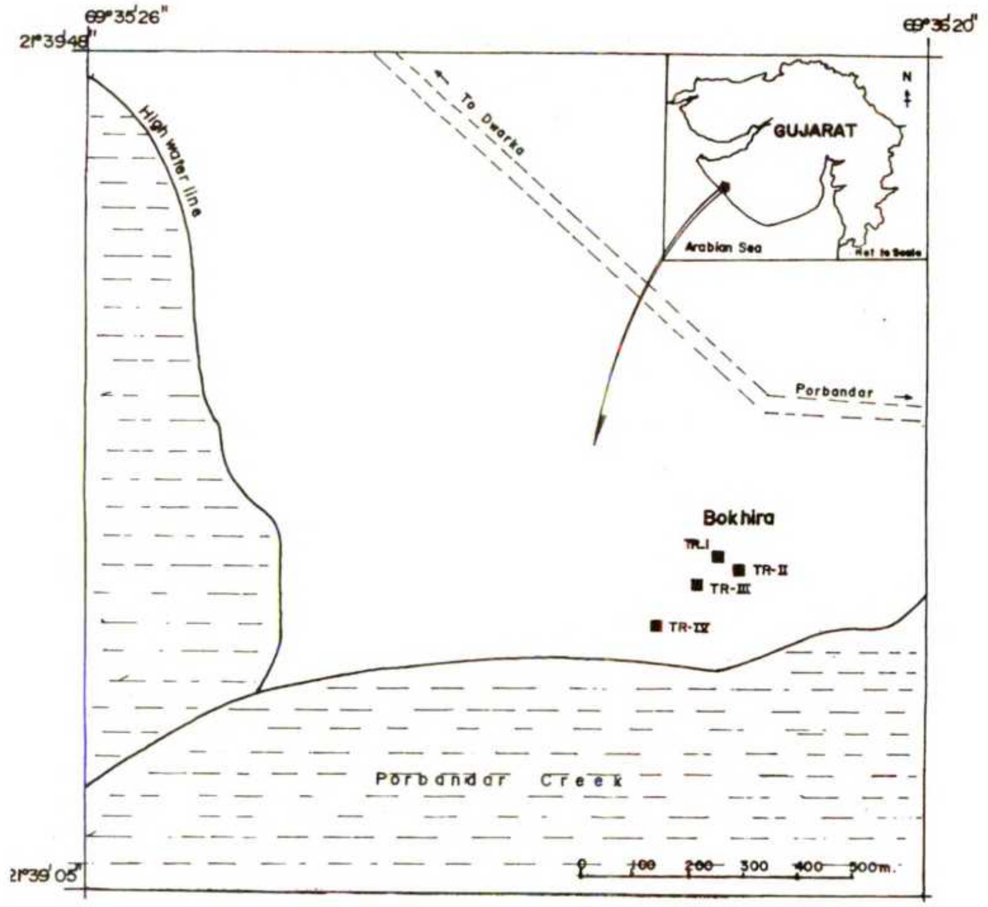

Fig. 1: Location of the trenches at Bokhira

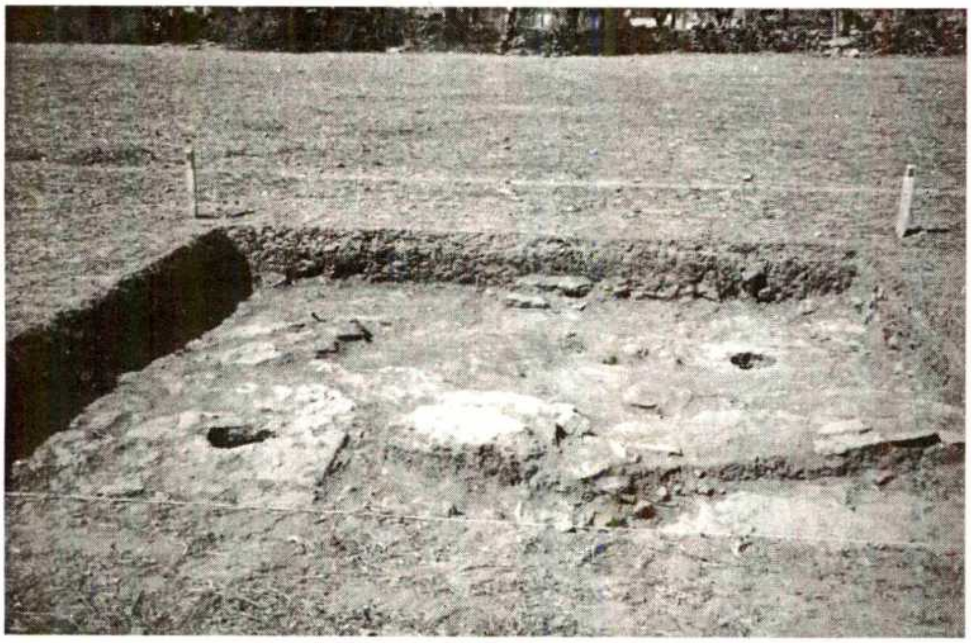

Fig. 2: Bokhira: post holes in trench 1

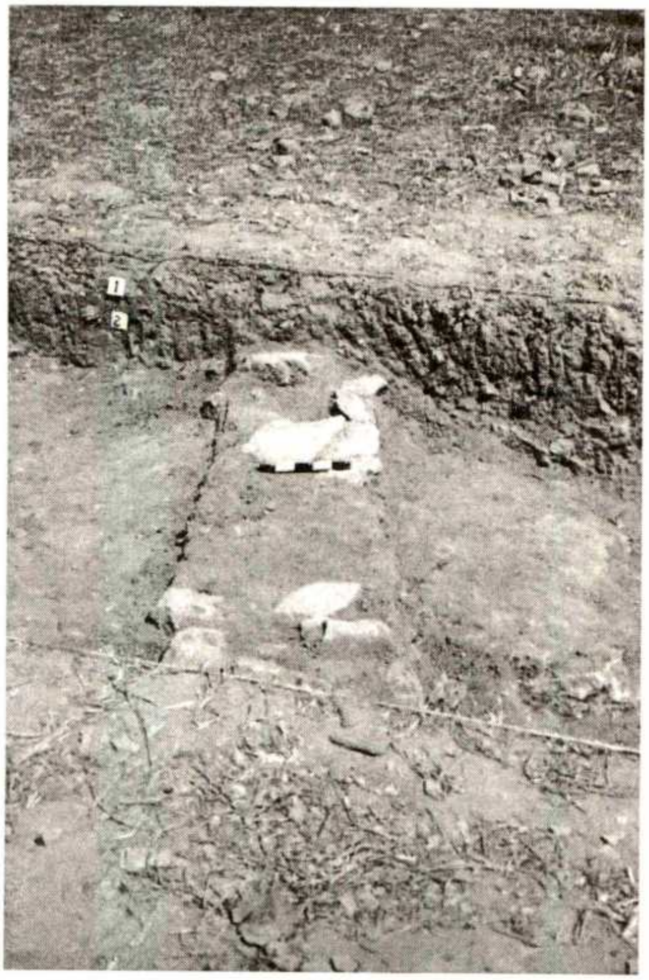

Fig. 3: Bokhira: structure seen in trench 1

Trench 3

The trench was laid south of the trench 1 and measures 2.5 x 2.5 m. A total habitational deposit of 70 cm was recorded and three layers were identified. A structure appeared on the northeast corner of the trench. The structure was sealed by layer 2 and continues through layer 3, resting over the bedrock. The structure is oriented east-west and is 1 m long and 20 cm in height. Potsherds are similar to those found in Trenches 1 and 2.

Trench 4

This trench was laid around 110 m from the modern creek and to the south of the Minaxi Ice Factory, and aimed at tracing remains of any port installations. A total habitational deposit of 103 cm was recorded and five layers were identified. The pottery is very similar to that in the other trenches. A broken terracotta bead was found. Interestingly, a very hard and compact layer was noticed (designated Number 3) and was sampled, analysis of which will be done.

Pottery

The important ceramic assemblages are red ware, black ware, buff ware and grey ware. A variety of bowls of different sizes was an important discovery, as also a large number of sherds of jars, lids, basins and other pots. The shape, size and paintings are very similar to that reported from Bet Dwarka (Gaur *et al.* 2005), Rojdi (Possehl and Raval 1989), Lothal (Rao 1985) and Kuntasi (Dhavalikar *et al.* 1996). Important paintings on the potsherds (Fig. 4) are roundels, wavy lines, cross lines and thick bands on the rim portions.

Other Antiquities

Important antiquities include four stone tools, four terracotta beads, two balls, three sling balls, one copper finger-ring and two terracotta artefacts. A brief description of the antiquities is given below:

Stone tools (Fig. 5)

1. Point in milky quartz. Six flake scars are noticeable. The tip is broken. It has sharp edges, and measures 24 x 13.4 mm.
2. Blade on crystal quartz. One flake scar is noticeable. A prominent and positive bulb of percussion is seen. It has sharp edges and measure 34.5 mm x 23 mm.
3. Fluted core on milky quartz. Three flake scars are noticeable. It measures 41.5 x 39.5 mm.
4. Waste piece on milky quartz, with sharp edges, and measuring 46.5 mm x 31 mm.

Beads and balls (Fig. 6)

1. Broken truncated bicone circular bead, with a smooth surface, and a thick axial hole. It has a coarse fabric and is ill fired. It has a diameter of 34 mm, height 25 mm, and the diameter of the hole on one side is 10 mm and other side 7 mm (BKR-TR-1).
2. Terracotta bead with a wide axial hole. It has a carinated shoulder, and a.smooth surface., and is treated with red wash. It has a fine fabric and is well fired. The diameter is 40 mm, with a height of 25 mm, and the width of the hole is 15 mm. Similar beads have been reported from Rojdi (Possehl and Raval 1989, Fig. 80.2) and Kuntasi where they have been called ear studs (Dhavalikar *et al.* 1996, Fig. 7.52: 31-32) (BKR-TR-4).
3. Spheroid broken circular bead. It has a rough surface, and is treated with a white colored slip which has flaked off at places. It has a coarse fabric and is well fired. It has a diameter of 33.5 mm, height 23 mm, and the width of the axial hole is 13 mm (BKR-TR-4).

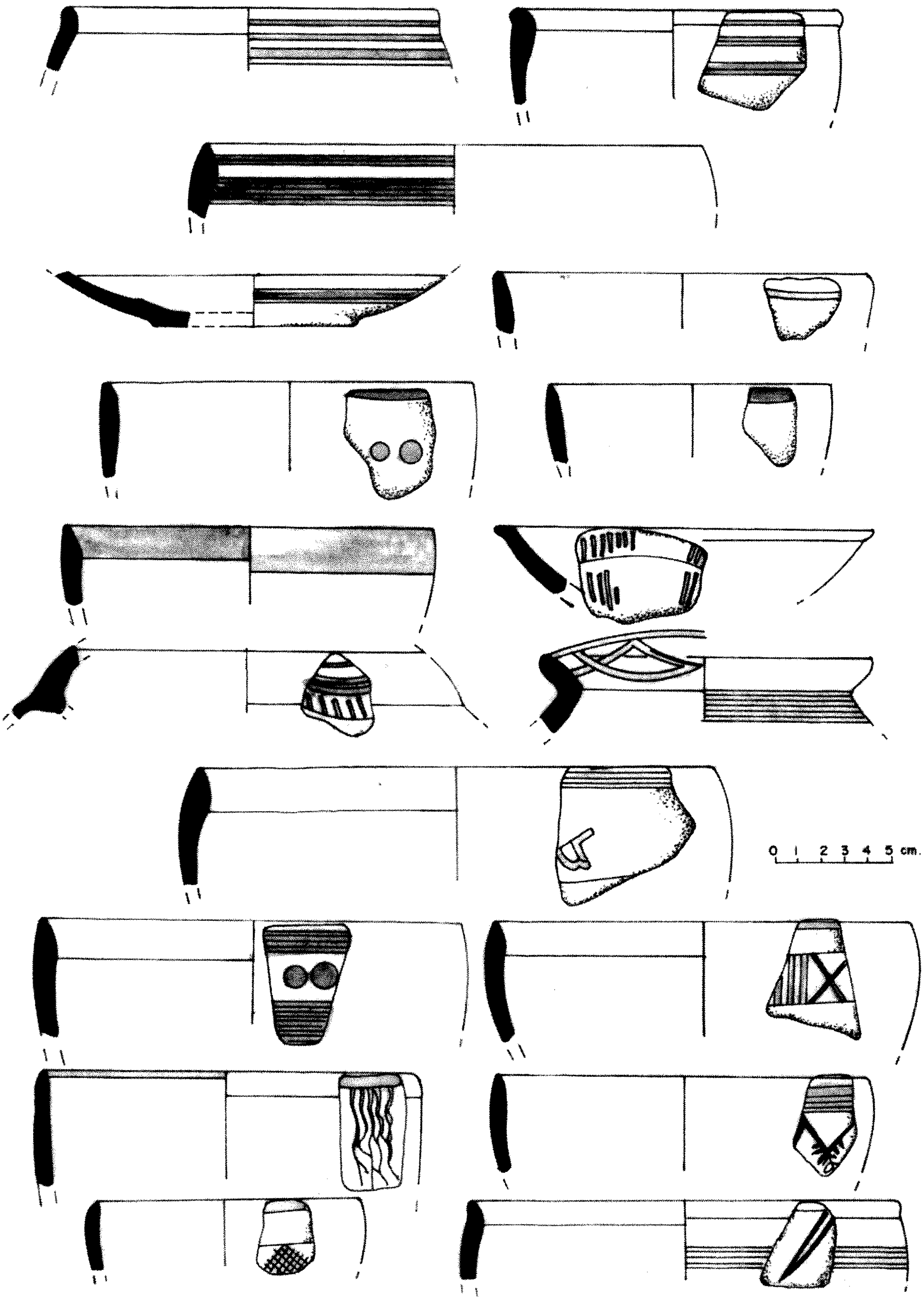

Fig. 4: Bokhira: the pottery

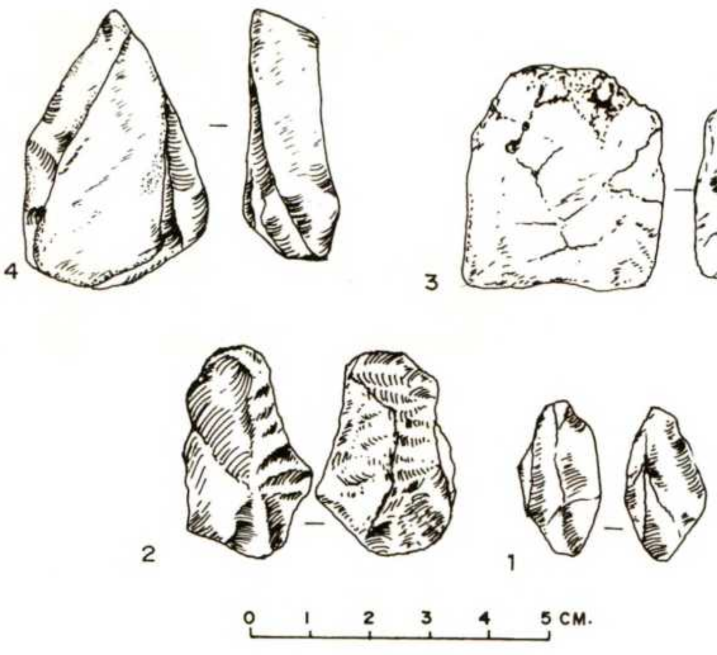

Fig. 5: Bokhira: the stone tools

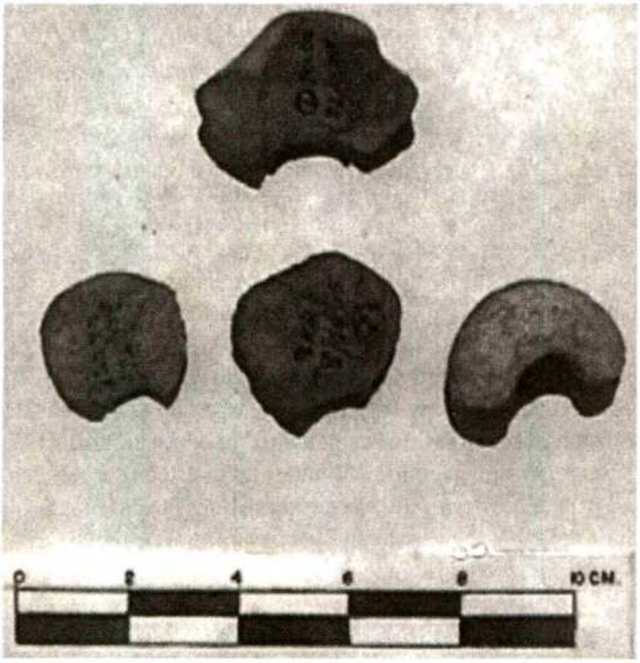

Fig. 6: Bokhira: terracotta beads

4. Broken truncated bicone bead of sun dried clay, with a smooth surface. The diameter is 34 mm, height 20 mm and width of the hole is 11 mm (BKR-TR-3).
5. Stone ball, with a smooth surface. The diameter is 25 mm (BKR-SUR).

5. Broken terracotta ball with a rough surface. The diameter is 29 mm (BKR-TR-1).

Copper object

Copper finger ring with a heart shaped pendant on it. The outer diameter is 21 mm, and inner diameter is 15 mm (BKR-TR-1).

Sling balls (Fig. 7)

1. Sling ball of limestone, with a rough and porous surface. The diameter is 52 mm (BKR-TR-1).
2. Sling ball of limestone. It is irregularly shaped with a rough surface. The diameter is 42 mm (BKR-Sur).
3. Irregular sling ball of limestone, with a rough and porous surface. The diameter is 41 mm (BKR-TR-3).

Chronology

The excavation revealed for the first time, the oldest antiquities around Porbandar, which date back to the beginning of the 2nd millennium B.C. The archaeological material is very similar to that reported from Rangpur IIB and IIC, Rojdi C and Bet Dwarka. Pottery is very similar to that of the Sorath Harappan suggested by Possehl in Rojdi, which has been well dated to the mid-third millennium B.C. Four samples (Table 1) have been dated by radiocarbon dating. Only one date is close to the archaeological time bracket suggested, two dates are much older than the expected time of the settlement, and one date is much younger than the age proposed. However, the archaeologi-

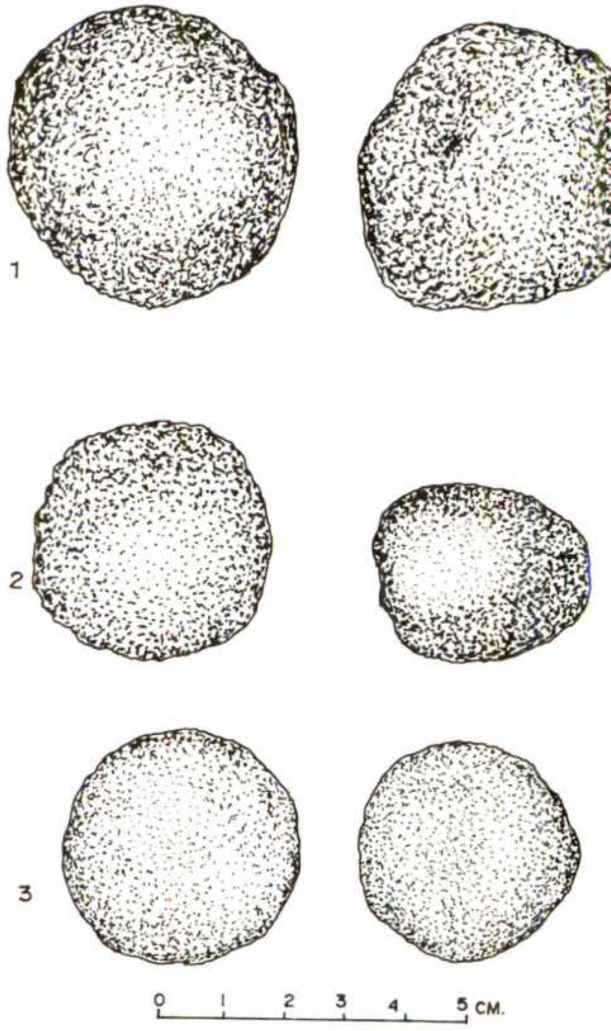

Fig. 7: Bokhira: sling balls

cal material is similar to many other Harappan sites on the Saurashtra coast and the settlement may be bracketed between the mid 3rd millennium B.C. and the end of the second millennium B.C.

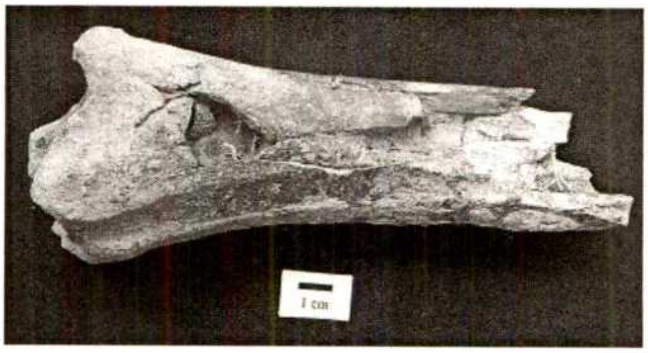

Fig. 8: A fragment of tibia of cattle

The Faunal Remains (Fig. 8-9)

The faunal material (TF=98, 2.416 kg) was analysed at the Deccan College Archaeozoology Laboratory using the standard protocol of laboratory analysis, data storage and quantitative analysis. It was possible to identify 72 (73.47%) fragments. A majority of the fragments were fresh and not subjected to post-depositional trampling and/or displacement. The skeletal assemblage from trench T-4 included a fragment of a human radius that is devoid of any marks. The general condition and the pattern of preservation indicates that it belonged perhaps to the same context as the animal skeletal elements. A few skeletal elements showed marks of charring, butchering activities and gnawing. There were two bone tools, one each from layers 2 and 3.

Although the faunal assemblage is small, it revealed the presence of both domestic and wild animals. Domestic animals include cattle (*Bos indicus*), buffalo (*Bubalus bubalis*) and goat (*Capra hircus*). Two wild animal species identified at Bokhira are the nilgai/blue bull (*Boselaphus tragocamelus*) and wild buffalo (*Bubalus arnee*). A major portion of identified bones belonged to cattle and buffalo. The proportion of wild mammals and non-mammals (such as crab and fish) relative to domestic ones is very small. It indicates that these wild and marginal resources, had a role to play in the subsistence economy of Bhokira. Although

Table 1: Bokhira: Radiocarbon dates

Sample No	**Lab No.**	**Age of the sample**	**Calib Age**	**Reservoir Correction**	**Calibrated age**
BKR-T1, Depth 15 cm	2423	8070±190	8130	7270	8360-7880
BKR-T3 Depth 30 cm	2429	2150±110	1290	1350	1490-1130
BKR-T1 depth 25-47 cm	2444	4790±100	4520	3990	4800-4300
BKR T-4, Depth 70	2453	9480±150	8680	9790	9930-9440

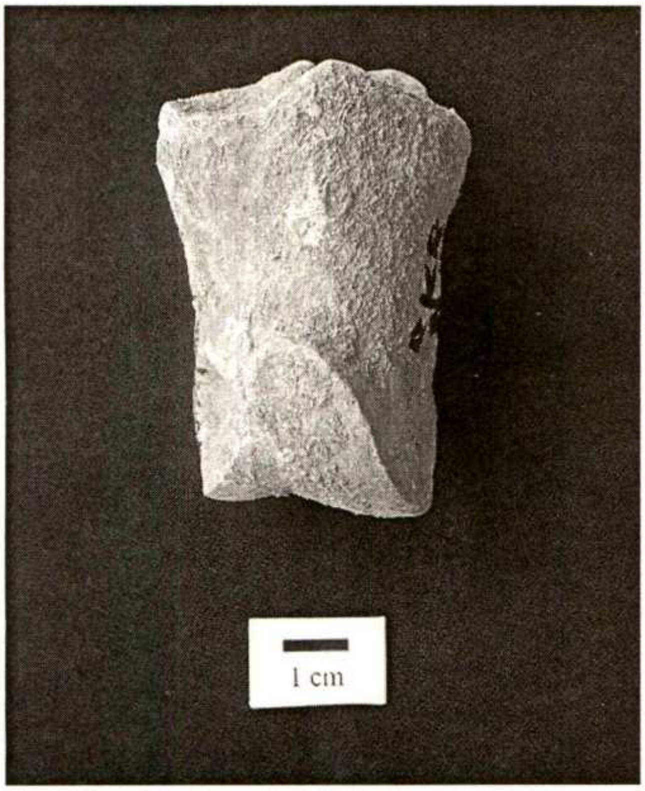

Fig. 9: Wild buffalo second phalanx

this archaeological material is small, it has highlighted the potential of the site for future understanding of the people and their economy.

Discussion and Conclusion

Excavations at Bhokhira brought to light the oldest site in Porbandar, dating back to the 3rd millennium B.C. It is the second site (after Bet Dwarka) discovered on the coastal plain, which has very little deposit of the Protohistoric period. The initial habitation took place on the bedrock and the Porbander creed would have been used for maritime activities since the earliest times. Houses had thatched roofs, which were erected on wooden poles as evident from postholes noticed on the surface. This is a characteristic feature of the Chalcolithic culture and rarely noticed in the Harappan civilization. Pottery and antiquities are very similar to those reported from Rojdi (Possehl and Raval 1989) and termed as "Sorath Harappan". However, this site has not revealed any significant structures such as those seen at Rojdi. After a few years of occupation, some rudimentary structures were made, as is evident from the discovery of an irregular small stone structure in Trench 1. Based on the deposit, it may be suggested that the habitation would have lasted less than, or around a couple of centuries. Their economy would have been based on marine resources such as shells and fish, as shell artefacts were obtained in the excavation. This discovery also indicates that along with the Indus Civilization, regional cultures flourished in the coastal belt of Saurashtra and were engaged in maritime activities. The antiquities and radiocarbon dates suggest that habitation at Bhokhira may be bracketed between the mid third millennium B.C. to the beginning of the 2nd millennium B.C.

Acknowledgements

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Man-Land Relationships in Ancient Coastal Karnataka

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Abstract

Coastal Karnataka has evidence of Palaeolithic, Mesolithic, Neolithic, Megalithic and Early Historic cultures. This coastal strip has also witnessed sea level fluctuations and climate changes including variations in vegetation. This paper attempts to examine the distribution of sites of different cultural periods and looks at how different cultures adapted to changing environments. This is done taking into consideration recent investigations in the region. The paper also stresses on the use of a multidisciplinary approach towards the study of past cultures.

Introduction

Coastal Karnataka occupies an important strategic position, both culturally and geographically, along the West Coast of India. Palaeolithic, Neolithic, Megalithic and Early Historic cultures grew and flourished in this region. The coastal strip also witnessed sea level fluctuations, variations in vegetation cover and climatic changes. This paper explores the symbiotic relationship between these cultures, the landscape and other resources in the light of recent investigations. The paper puts forward a summary of recent archaeological discoveries in coastal Karnataka along with a discussion on past environmental changes in the region and stresses the need for a multidisciplinary approach in understanding man-land relationships in coastal regions of India.

Coastal Karnataka

Coastal Karnataka lies approximately between 74° 35' to 75° 40' E and 12° 27' to 15° 31' N, with a 400 km long coastline. It comprises the modern districts of Dakshina Kannada, Udupi and Uttara Kannada which were previously known as South and North Kanara districts. This coastal belt is bounded by Belgaum district and Goa on the north; the Malnad areas of Dharwad, Haveri, Shimoga, Chikkamagalur and Hassan on the east; and the Cannanore and Madikeri districts respectively in Kerala and Karnataka on the south; and the Arabian Sea on the west. The coastline marks a transition between the Konkan coast in the north and the Malabar coast in the south, and is endowed with many natural harbours and port towns.

Geomorphologically the coastal region consists of three broad divisions; a) the coastal plains; b) the hilly region; and c) the Western Ghats. Partly formed by marine denudation, the coastal plain is a narrow stretch rarely exceeding 30 km in width. The estuarine plains of the Kali, Tadri, Gangavali and Sharavati rivers separated by low east-west offshoots of the Sahyadris. The landmass immediately adjoining the shoreline is a relatively narrow belt of very recent deposits consisting of sand dunes estuarine mud flats and valley plains. The region between the coastal fringe and the Western Ghats consists of a cluster of hills of the sub-Sahyadrian zone. The Western Ghats rise in a series of terraces and run north-northwest to south-southeast for about 320 km.

Geologically, the coastal plain adjoining the Arabian sea over a width of about 10 to 20 km inland, is covered with recent and sub-recent deposits and lateritic formations. They consist of alluvial formations, clays, red or dark clay soils and laterite like or lateroid formations. Alluvium is also exposed mostly along the riverbanks and estuaries. Archaen rocks cover the rest of the area and contain intrusives like dolerites, basic and ultra-basic rocks, charnockites and granite gneisses. The Dharwar group has older metamorphic rocks, garnetiferrous quartz, sillimanite, talc-schist, hornblendes schist, chlorite schist and banded haematite quartzite.

The coastal region is also rich in mineral resources like iron, manganese, limestone, bauxite, copper, mica, steatite, dolerite dykes, quartz, lime shells, gold, corundum, garnet, kyanite and soap stone. Iron occurs in Sunkadakatte, Vitthal-Kanyana hill range, Keradi and Nidle areas in the southern region, whereas in the northern

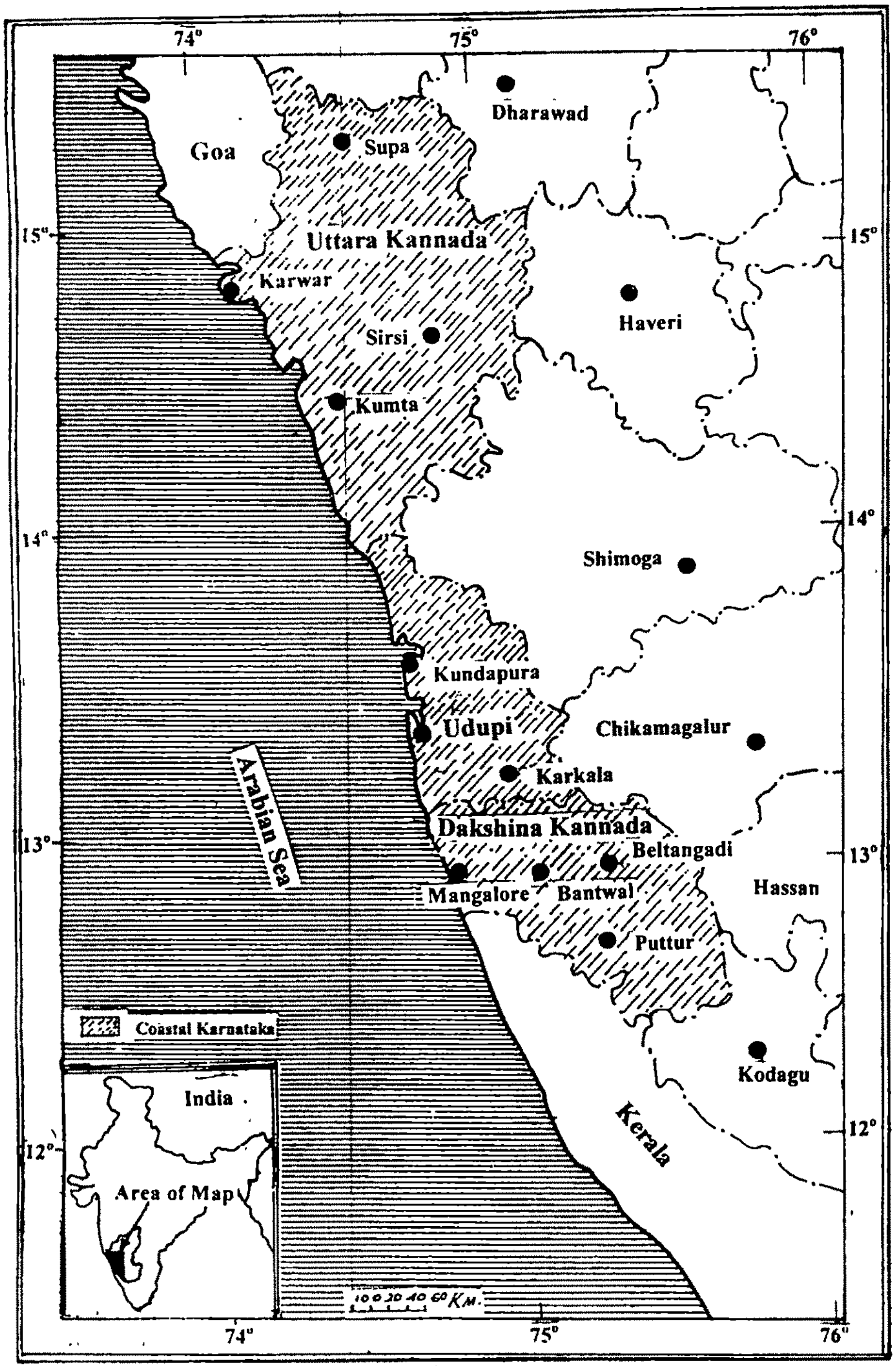

Fig. 1: Coastal Karnataka

area it is available in and around Apsarkonda, Bisgod, Kalche, Kodlagadde, Kuntagani, Kumta and Bhatkal areas including Nagari, Nagur, Madangeri, Achavegudde, Santepet, regions known for titaniferous iron ore. Alluvial gold is available in Mudnur river at Kavu in Puttur taluk.

The coastal belt is drained by rivers that originate in the Western Ghats, of which the Sharavati, Kali, Gangavali (Bedti), Aghanashini (Tadri), Netravati, Mahadayi, Varahi and Chakra are important. The Varada, a tributary of Tungabhadra is the only river flowing eastwards, which drains a part of the coastal stretch in Karnataka.

The region receives a heavy and assured rainfall between the months of June through August to September. The rainfall increases from the coast eastwards towards the

Ghats in the southern region, whereas it decreases from the coast eastwards in the northern areas. It has a distinctive ecology and is rich in fauna and flora. The slopes of the Western Ghats are covered with evergreen, semi-evergreen; moist deciduous; scrub, thorny and un-wooded forests. A wealth of fauna is found in the hilly tracts, while marine resources are also abundant in the rivers and the Arabian Sea (Abhishankar 1973; Kamath 1982, 1985).

Archaeology of the Coastal Region

Lower Palaeolithic Sites

Till recently, no Lower Palaeolithic sites were known in coastal Karnataka. Choppers made on quartz pebbles were found in the Netravati basin at Uppinangadi in Puttur taluk. The site is situated at a height of 30 m AMSL and is 51 km inland (IAR 1981-82: 27). A.K. Sharma and his colleagues of the Archaeological Survey of India (hereafter ASI) explored the West Coast and discovered tools including handaxes and scrapers on the slopes of a hillock on the left bank of river Kali at Jukheri, just 10 km east of Karwar in district Uttara Kannada. A majority of artefacts were highly weathered (IAR 1992-93: 46-47). L.S. Rao and his team from the ASI explored the entire West Coast in connection with the Konkan Railway Project during the years 1992-1994. A unifacial basalt chopper was found at Naravi in Beltangadi taluk (Rao 2004).

Middle Palaeolithic Sites

In 1982, a team of Indian and Japanese geographers while exploring the Western Ghats around Beltangadi-Naravi area discovered a Middle Palaeolithic implement from the humus pebbly-soil near a rest house at Naravi in Betlangadi taluk, district Dakshina Kannada. The tool is made on dark greenish felsite, and is classified as a borer-cum-scraper made using the Levallois technique (Shivarudrappa *et al.* 1983).

Mesolithic Sites

In 1981, Rajendran (1983) discovered two Mesolithic sites in the Netravati basin. These are Mani in Bantwal taluk and Uppinangadi in Puttur taluk both in district Dakshina Kannada. At Mani, tools were found as surface scatters on the lateritie hillock. However, at Uppinangadi artefacts occur in a stratified context, within a gravel bed, 1.15 m above the riverbed. These include scrapers, blades, borers, burins, lunates, cores and simple flakes. The industry is exclusively on quartz, however, a few of them from Uppinangadi were made on quartzite (IAR 1980-81: 31). Continuing the survey initiated by the ASI, Rao and his team located Mesolithic sites in the southern region in district Udupi at Baindur and Gantihole in Coondapur taluk; Andar Chouki, Jarkala, Karkala, Kukkunduru, Mudakonaje, Sanur in Karkala taluk; and Haradi in Udupi taluk. In district Dakshina Kannada sites found include Machchina and Bada Kajekaru in Bantwal taluk. A few rock shelters and natural caves were also found at Kukkunduru and Mirjan. The microlithic industry consisted of mainly blades, points, burins (?) borers, fluted cores and flakes (Rao 2004).

Mesolithic sites were also discovered at Masikere, Avarse, Gavali, Guddettu and Kolanakallu in district Udupi (Shivatarak 2001, 2004), as also at Nancharu near Avarse and Sastavu near Petri both in Udupi taluk and Kadtala in Karkala taluk, all in district Udupi. Artefacts from the latter group include points, crescents, etc. made on quartz and quartzite from these sites.

Turning to the northern region, Joshi *et al.* (IAR 1972-73: 26-27), while exploring the area around Gokarna and Karwar, found a few Mesolithic sites near Belekeri and Hattikeri in Ankola taluk, district Uttara Kannada. This industry consisted of scrapers, points, flakes and blades all made on quartz. In districts Uttara Kannada, Rao and his colleagues discovered sites at Bhavikere, Hausa, Kanchibail, Shiragunji and Sulerbail in Ankola taluk; Hadahir and Tallan in Bhatkal taluk and Gokarna, Harnit, Kumta, Mirjan and Mudangi in Kumta taluk. A few rock shelters and natural caves were also found at Mirjan (IAR 1992-93: 47-48; Rao 2004).

Neolithic Sites

As early as 1968-69, S.R. Rao and A. Sundara discovered a ground stone axe near Shiva temple at Honnavara; and a few sherds of coarse grey ware akin to Neolithic grey ware of Maski fabric in rock-shelters on hill slopes near Ramatirth at Gokarna (IAR 1968-69: 24). Subsequently, the latter expressed reservations on the true characteristics of the specimen (Bhatsoori 1990). In view of these reservations, the first authentic discovery of a Neolithic axe in coastal Karnataka was made by K.G. Bhatsoori in 1986-86. The axe was located at the Shiva-Devi temple complex near the village Anmod in Uttara Kannada district. It is made on basalt and measures 24 x 7 x 3 cm (Bhatsoori 1990). In 1993-94, Sharma and his colleagues reported a Neolithic site at Anshi in Karwar taluk, Uttara Kannada district (IAR 1992-93: 46-47). Rao and his team found a mace-head from Kumta and two highly patinated axes from Neelakonda in Kumta taluk, Uttara Kannada district (IAR 1992-93: 47-48; Rao 2004). A Neolithic site has been reported from Shirpur in Supa taluk in district Uttara Kannada (Shivatarak 2001).

In the southern region, a Neolithic axe was accidentally found during agricultural activities in a field located along the slopes of a hillock on the northern bank of river Sita near Bandi Math in Udupi taluk. This axe is fashioned on dolerite with a sharp working edge and measures 12.3 x 6.4 cm (Shetty 1987). A highly polished axe measuring about 25.5 cm in length was found on the river Suvarna near the village of Haradi between Kukkade-Kadavu and Timmanna Kadru in Udupi taluk. In 1989 another axe made on dolerite and unpolished measuring 11 x 4 cm, was found while digging earth at Kotatattu from Udupi taluk. Subsequently, another axe was collected while excavating an elevated area near Sri Vani High School in Naduru (Shetty 1991). A few quern fragments were reported from Kotatattu (Rao 2004). Recently, Narasimhamurthy (2006) brought to light a Neolithic habitation site at Paje hills, Kurkalu, in district Udupi. The associated pottery is generally grey or pinkish buff ware with white grit and irregular striation marks on the interior (Narasimhamurthy 2006); and resembles the typical Neolithic and Neolithic-Chalcolithic ceramic industry of excavated sites like Sanganakallu II (I) of Subba Rao (1948) and III (I) of Ansari and Nagaraja Rao (1969), Hallur I and Tekkalakota I in the lower Deccan (Patil 2004-05).

Megalithic Sites

Gururaja Bhat discovered the first megalithic site consisting of port-hole chambers at Bada-Kajekaru in Bantwal taluk, district Dakshina Kannada, which was locally known as *Pandavarakallu.* Subsequently, he located Megalithic sites at Bir-Male on the outskirts of Puttur, district Dakshina Kannada; and Beluru (Chamtadi), Muda-Nidamburu (Bommara-Bettu), Perampalli, Santur and Vaddarase, all in district Udupi (Bhat 1969; 1975). Rao and Sundara located a Megalithic site at Balerugudda in the vicinity of Udyavara in district Udupi from where Megalithic Black-and-Red ware, Black Polished, Plain Red and Cream wares were collected (IAR 1968-69: 24). Sundara revisited the Megalithic sites at Bada-Kajekaru, Belur (Chamtadi), Bir-Male (Puttur), Muda-Nidamburu (Bommara-Bettu), and Vaddarase, reported earlier by Gururaja Bhat. Amongst the antiquities found, a highly rusted iron chisel with a hollow shaft and a piece of an iron sickle blade, a star shaped eight-lobed thin pendent and a ring (?) in gold from Bir-Male, deserve special mention. Based on megalithic Black-and-Red ware and other associated finds from these sites, he classified megaliths into different types. Thus, he noted urn burials at Bir-Male; those at Bada-Kajekaru and Belur (Chamtadi) were port-holed chambers. A few were bench-like Megaliths from the latter locality and a rock-cut cave, perhaps a Megalithic hemi-spherical chamber, circular on plan with an opening at the top was noted at Bommaru-Bettu. He also suggested that the urn burials of Bir Male were similar to the ones found at Porkalam in Kerala; and the port-hole chambers were identical to Rajankolur-Aihole groups in the north Karnataka region (Sundara 1974; IAR 1973-74: 68).

Vasantha Shetty noted Megalithic sites at Anjaru near Hiryadka, Barali near Mandarti, Bellarpadi, Bolugudde, Brahmavara, Kelakunjal, Kiradi near Avarse and Marikoma in Udupi taluk; Amase Bail, Halladi-Harkadi, Kadase, Nidladi and Ultoor in Coondapur taluk and Belanje and Char near Hebri in Karkala taluk, all in district Udupi. All are lateritic rock-cut caves with circular burial chambers having hemispherical elevations and circular openings on the top. He also located a group of twelve megalithic port-holed chambers spread over an area of 3-4 km at Kakkunje in Udupi taluk. With the exception of one megalith, all were badly disturbed. He also discovered rock bruisings at Gavli near Halladi-Harkadi in Coondapur taluk. These depict a group of animals amongst which a bull with a prominent hump and horns is notable (Shetty 1990, 1991).

Ganapayya Bhat has brought to light the importance of Megalithic sites at Parkala and Subhash Nagar in Udupi taluk; Mudakonaje in Karkala taluk in district Udupi and Kandadka in Puttur taluk, Vagenadu in Bantwal taluk and Aivarnadu in Sulya taluk, all in district Dakshina Kannada (Bhat 1978, 1990, 1998). The other Megalithic sites found were Bagger Kyara (Shivra), Udupi, Kalyanapura (Laxminagar) and Pedroru in district Udupi (Shivatarak 2001).

In district Uttara Kannada, along the northern region of the coastal belt, a Megalithic site was found at Kantraje near Banavasi in Sirsi taluk (Sundara 1974). In 1975, the rock-bruising were accidentally discovered at Bole, situated at a distance of about 1.5 km from Ankola. These depict mostly oxen, elephants, deer and fish (Sundara 1994). Megalithic stone circles were found at Muttala Koppa on the left bank of river Varada near Banavasi in taluk Sirsi (IAR 1983-84: 46-47). At Kilar in Siddapur taluk, a lateritic rock-cut chamber, circular in plan and hemispherical on elevation with a circular opening at the top covered with a capstone, was discovered, besides the sites near a farmhouse near Dandeli in Haliyal taluk (Bhat 2004) and at Shiralagi in Siddapur taluk (Ganapati Gowda 1992).

Early Historic Sites

Rao and Sundara surveyed various mounds at Banavasi and suggested that this was a flourishing city in the third century B.C., if not earlier. They explored the well-defined citadel at Balerugudda in the vicinity of Udyavara in district Udupi. This has three gateways, and a lower town facing the sea. It yielded a large quantity of pottery comprising Megalithic Black-and-Red Ware, Black-Polished, Plain Red and Cream Ware. On the basis of this citadel of the Early Historic period and the remains of a Siva temple, the authors suggested that the scene of action mentioned in the Greek farce, *Oxyrhynchus Papyri* with Kannada passages is set at the ancient port of Udyavara. The other interesting finds were a chert blade and sherds of Cream ware (IAR 1968-69: 24). Sundara during his explorations in district Uttara Kannada, found an Early Historical habitation site with remains of brick structures at

Haigunda in taluk Honnavara. The remains of a brick temple with a Shivalinga were found. In an elevated area known locally as *Aramane Dibba* (palace mound) there were remnants of brick-buildings. According to him this represents a citadel. The ceramic industry and bricks are dated to the Early Historic period, similar to those found elsewhere in Karnataka, such as at Brahmagiri, amongst other sites. Hattiangadi in district Udupi, was possibly a flourishing commercial town as well as centre of authority controlling trade (IAR 1973-74: 68; Sundara 1991).

Banavasi, once the capital of the Chutus and Kadambas, is located in the hinterland of coastal Karnataka, and was excavated first in 1970-71 and later from 1994-1996. It has a four-fold cultural sequence, of the Chutu, Satavahana, Kadamba and post-Kadamba phases. No structures were encountered in the Chutu levels, whereas in the Satavahana period an enclosure wall and an apsidal brick structure were identified as a temple or *chaitya.* A square platform built of baked bricks was also exposed. Important antiquities in Period I comprise lead coins of Sivalananda and Sadakana; beads of carnelian, quartz and agate. An interesting feature was the occurrence of beads in various stages of manufacture along with raw material, which suggests the prevalence of a lapidary industry at Banavasi. From Period II, a variety of terracotta sculptures particularly the mutilated Hariti Yakshi, face of Buddha and Bodhisatva with a *chaitya* in the crown; two seals with fish design; a ram's head and a sherd of a soapstone casket or container with an inscription in pre-Christian Brahmi characters assignable to *circa* second century B.C. or even earlier, lead and copper coins, beads of semi-precious stones, gold plated lac beads, terracotta beads, bangles, copper objects, goldsmith's touch stones, and pounders and grinders, are the other important antiquities of interest (IAR 1994-95: 40-41; IAR 1995-96: 42-45).

Another important feature of the Early Historic period was the existence of a variety of port-towns all along the West Coast. These can be classified as island ports as seen at Devagadh and Anjadiv; river and swamp-ports like Sadashivagadh; and creek ports such as those of the Karwar type; etc. The growth of ports was aided by the excellent connectivity between ports and the hinterland via estuaries and river systems. Equally important for their development were 'pre-sailing' halting places like Jalikunda and Basavarjadurga.

Discussion

The Acheulian occupation in Goa, along the West Coast, might have coincided with a dry phase during the Pleistocene with the onset of savanna type climatic conditions (Goudeller and Korisettar 1993). This holds good for most of the coastal region under investigation as well as for coastal Karnataka contiguous to the region around Goa. The local mineral resources were exploited to fashion implements. A variety of roots, cereals and fruits formed important food resources. Wild animals and aquatic species supplemented the diet. However, evidence currently available does not permit substantiation of the exact resources exploited by early hunter-gatherers, as also whether aquatic resources were exploited.

In the study region, no less than thirty-five Mesolithic sites are reported. These are located in varied contexts, such as on the surface of low lying granite hillocks, lateritic plateau zones, on hills, riverbanks, rock shelters and natural caverns. The increase in number of sites and their widespread distribution points to a demographic increase in the coastal region. A range of implements were fashioned on locally available quartz and quartzite. It is well known that exploitation of aquatic resources increased only during the Mesolithic and also played an important role in economic prosperity. A variety of marine and freshwater fauna available in this region would have been an excellent resource for these communities.

The presence of a few Neolithic sites point to the existence of early farming communities in this region. Among the sites, Paje hills at Kurkalu has yielded axes in association with pottery, Haradi is on the river Suvarna while the axe from Bandi-Math is found on slopes of a hill. The location of these sites is almost identical to settlement pattern of known sites in Karnataka. The implements were on locally available dolerite and are typo-technologically akin to the southern Neolithic and Neolithic-Chalcolithic cultural complex. The assured rainfall, elaborate water resources, fertile lands, native minerals, thick vegetation, wild animals, marine and fresh water species provided ample opportunities for Neolithic people to settle and prosper in the coastal region under consideration.

In coastal Karnataka, as mentioned earlier, there are as many as 39 megalithic sites, spread in three districts with a heavy concentration in district Udupi. Architecturally and functionally these graves can be grouped into four distinct types; 1) port-holed chambers; 2) urn burials; 3) rock-cut caves and 4) menhirs. In most cases it is seen that they used suitatable local rocks. Mineral resources, are another guiding factor in determining settlement patterns. As stated earlier, Sunkadakalte, Vittala-Kanyana, Keradi and Nidle areas in the southern part and a few other localities including Ankola, Honnavara and Yellapur areas in the northern region, are rich in iron ore deposits. These might have been exploited to fabricate iron implements. Similarly, gold could have been extracted from Mudnur river at Kava known for its alluvial gold sources. It may be recalled here that Bir-Male yielded both iron implements and gold ornaments, and trial trenching at Bade-Kajekaru has also produced an iron chisel. Interestingly, these sites are located not far from sources of iron and gold mentioned above. The location of some sites on riverbanks or close to rivers suggests availability of fertile land for agriculture and was a deliberate choice. Farming could have been predominant as also cattle herding and production of crafts such as ceramics, iron and gold products.

During the Early Historic period, archaeological remains, travelogues, and epigraphic and literary references indicate cultural contact and maritime trade along this region. Sites such as Udyavara, Haigunda and Banavasi were well-established centres, and indicate the affluence of communities along the coast. In their classification of Early Historic sites into villages, towns and cities, scholars identify Banavasi as a city (Nagaraju 1985). Similarly, Haigunda and Udyavara were placed in the category of towns. An important aspect was the presence of ancient routes and road networks, connecting places, with a principle centre among them. Haigunda located on the mouth of the river Sharavati and Banavasi on the river Varada were important places that connected hinterland settlements with the coast. Accounts of foreign travellers like Pliny and Ptolemy and the *Periplus of the Erythrean Sea* (Schoff 1974) have a number of references to trade through Alvakheda (*Olokhoria*), Malpe, Mangalore (*Mangarouth),* Udyavara, Barkur, Basrur and Honnavara (*Naura*). Comparative studies of epigraphs of Karnataka with those of South Asian countries have brought to light cultural contacts and trade relations. Mention of Buddhagupta (Chhabra 1965) and Usauna (Katti 1987), the *mahanavikas* and a newly found inscription in Mexico suggest contacts. Grants made by merchants of Banavasi to the *chityas* of Karle (Nagaraju 1981) and contemporary art traditions highlight the impact of Buddhism on trade in this region.

Archaeological evidence must be viewed within the context of past environmental changes. Studies on sea level changes along the West Coast have been conducted by numerous scholars (Agarwal *et al.* 1973; Hashimi *et al.* 1993; IAR 1972-73: 26-27). Local legends on sea level changes are related to the legend of Parasurama, and the coastal region of Karnataka is traditionally known as *Parashurama Kshetra* or *Parashurama-Shristi.* Early studies in 1973 by R.V. Joshi and others (IAR 1972-73: 26-27) relate to changes in the sea levels during the Quaternary, around Gokarna and Karwar belt. Agrawal and his colleagues observed that prior to 30,000 to 35,000 BP the sea level was much lower than today. Sea levels rose from around 30,000 BP and subsequently regressed, to rise again *circa* 15,000 BP attaining a maximum during the mid-Holocene (Agrawal *et al.* 1973). A few C-14 dates also indicate sea-level changes on the West Coast. A carbonised wood piece (TF-1089) from Panambur harbour area in district Dakshina Kannada found at a depth of 12.5 m is dated to 38460/+5105-3190 (36,510 B.C.) (IAR 1971-72: 83-84). Another wood piece (TF-966) from Kulur near Mangalore collected at a depth of 13.7 m below surface has been dated to 38444+/-6150/-3490. The coral (TF-983) from the continental shelf at Karwar has provided a date of 9135+/-130. Recently, another set of sea-level curves for the West Coast were constructed (Hashimi *et al.* 1993). They show a low at 100 m depth around 14,500 BP and another low of 80 m depth at 12,500 BP. Between 10,000 and 7,000 BP the sea level rose at the rate of 20 m per 100 years and since 7,000 BP the sea-level has remained steady as at present (Hashimi *et al.* 1993).

Palynological investigations of the marine cores off Karwar, at the mouth of river Kali shows a marked change in the forest pollen of the Western Ghats since 3500 BP. A decrease in the forest pollen and corresponding increase in savannah pollen took place between 3500 and 2200 BP. Microfaunal assemblages attest to this shift from humid to less humid conditions. This evidence suggests the prevalence of less humid climatic conditions since about 2200 BP (Caratini 1993). Studies of planktonic foraminifera point to higher rainfall regimes at 280, 840, 1610 and 2030 BC, while low rainfall regimes prevailed at 420, 910 and 1680 year BP (Nigam 1993).

Ethnographic studies of modern coastal communities aid in the study of adaptive strategies along this coastal tract. The Koraga (Abishankar 1973; Morab 2003), Maila (Bilimale 2003), Kudubi (Navada 2003a, Abhishankar 1973), Maleru (Patil 2003), Mogaveera (Krishna Murthy 2003), Harikantra (Ravindranath 2003) and Kharvi (Navada 2003b), Baira (Panduranga 2003) are important communities involved in hunting-gathering and fishing, and who are recently engaged in some amount of agriculture and other crafts. Among these, communities like Mogaveeras are native to this area, while the Kharvi and Kudubi have migrated from the north Konkan coast. Studies of these groups may help provide insights into past life-ways.

Sea level fluctuations along with climatic changes wherein the Western Ghats experienced variations in the vegetation, might have led to environmental hardships for prehistoric communities. An increasing ability to adapt to changing environmental and climatic conditions helped these early communities prosper in this coastal region. Hunting supplemented by exploitation of aquatic resources became an inseparable lifestyle from the Mesolithic onwards. Livestock breeding and farming became an essential trait from the Neolithic period, which was ultimately transformed to a mastery over metal technology during the Iron Age. This ultimately culminated in urbanisation with celebrated trans-oceanic trade.

This paper has put forward a summary of the nature of archaeological sites along part of coastal Karnataka. An attempt has been made to summarise data on environmental changes to which coastal communities would have adapted to in the past. The relationship between man and the environment is a crucial factor to be considered, and in coastal regions, this assumes new dimensions owing to its specific geographic features.

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A Gazetteer of Archaeological Sites in Rajasthan (From Palaeolithic to Early Historic)

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Introduction

This gazetteer contains a list of 1188 sites of 20 cultural periods/stages. It is primarily based on sites reported in the *Indian Archaeology – A Review* (IAR), but is supplemented with others reported in exploration and excavation reports, articles in journals, and Ph.D. dissertations. Several hundred sites simply labelled as 'Historic' in the IAR have not been included in the gazetteer because their period (early or medieval) has not been mentioned. I am fully aware that the gazetteer suffers from a number of limitations and flaws. First, I did not have access to all the Ph.D. theses completed on the archaeology of Rajasthan, and hence the list cannot be claimed to be complete. Secondly, the sites reported in IAR suffer from more limitations than those reported in other sources. In many cases the same site has been reported more than once by different explorers as well as by the same explorer(s), and sometimes the spelling varies even in the reports by the same explorer. So one cannot be sure whether the same site or a different site is referred to. In majority of the cases not only are the geocoordinates not given, but even the minimum locational details like distance and direction from the nearest settlement and relationship with prominent geographic features like river, nala, lake, hill, etc. are not provided. Sometimes sites and cultural periods are mentioned without specifying their relationship. In Rajasthan, as in other parts of the country, certain place names are very common, and there is, not infrequently, more than one place of the same name in a district. In such cases, it is almost impossible to plot sites, for which locational details have not been given, even approximately on the map. In the vast majority of the cases only site names and related cultural periods have been mentioned with no details of the cultural material found in them.

In recent years five new districts have been created in Rajasthan by dividing the existing districts: Dhaulpur out of Bharatpur, Dausa out of Jaipur, Karauli out of Sawai Madhopur, Baran out of Kota, and Hanumangarh out of Ganganagar. However, since the exact location of most sites is unknown, in the lists we have shown the sites in the undivided district only.

The distribution of sites does not correctly reflect the original distribution of temporary camps as well as permanent settlements because many sites, especially those occupied for short durations and pertaining to periods when people were living a nomadic life, have either got destroyed by vagaries of nature and human use of the land surface for various activities or are lying buried in geological deposits. Many more sites must be awaiting discovery since fieldwork has been uneven. Some areas have been more intensively explored than others and some have not been explored at all.

However, despite all these shortcomings the gazetteer has been compiled for the satisfaction that something is better than nothing. It at least gives an indication of the broad distribution pattern of different cultures. For example, the semi-arid and arid region to the west of the Aravallis, which is very sparsely populated today, mainly because of the scarcity of water, has yielded a large number of sites of all the phases of the Stone Age. We know from varied multidisciplinary evidence that this region enjoyed good rainfall during the Middle and earlier part of the Upper Pleistocene and again from the terminal Pleistocene to circa 4000 years ago. The number of sites is a reflection of the availability of water and plant and animal food resources. However, during the later part of the Holocene the rainfall seems to have been both scarce and unreliable, and this inhibited the early (Chalcolithic and Early Historic) farmers from colonising the region. The exception was the Ghaggar valley in the extreme northwestern part of the region which was carrying perennial water from Himalayan glaciers, and was therefore, colonised by the Early and Mature Harappan people. It is not surprising that Harappan sites are confined entirely to this valley. Outside the valley, western Rajasthan does not seem to have been colonised by people practising a farming economy until early medieval times. The same is true of the hilly and forested region of the Aravallis. In the eastern part of the State, which is climatically more congenial, early cultures appeared but they have distinct regional distributions. Thus, the Ahar culture flourished almost entirely in the Mewar region, and Ganeshwar-Jodhpura (Ganeshwar-OCP) and Painted Grey Ware cultures developed in the northeastern part of the State.

Because of scarce rainfall, ample uncultivated and fallow land, good pasture, and sparse population over much of the State, wildlife and hunting-gathering mode of subsistence have survived right into the present.

Though sites of individual cultures are listed in separate tables, in the column of Comment/Explorer', name(s) of other cultures represented at a site are also given.

The following abbreviations have been used in the tables.

The 1188 sites belong to following cultural periods/stages and the abbreviations used in the tables are as follows.

S. No.	Period/Culture	Abbreviation	No. of Sites
01	Lower Palaeolithic	LP	86
02	Middle Palaeolithic	MP	66
03	Upper Palaeolithic	UP	08
04	Unpecified Palaeolithic		07
05	Mesolithic		160
06	Rockshelters		26
07	Ahar Culture		111
08	Early Harappan		08
09	Mature Harappan		29
10	Ochre Coloured Pottery	OCP	131
11	Ganeshwar-Jodhpura Culture		88
12	Copper Hoards		20
13	Painted Grey Ware	PGW	120
14	Megaliths		05
15	Early Historic	EH	121
16	Northern Black Polished Ware	NBP	16
17	Sunga-Kushana		12
18	Kushana		39
19	Rang Mahal	RM	124
20	Gupta		11

Following other abbreviations are used in the tables.

ArchMusRaj	Department of Archaeology – Museums, Rajasthan
ASI	Archaeological Survey of India
BGW	Burnished Grey Ware
B – R	Black-and-Red Ware
BSW	Black-Slipped Ware
Chalco	Chalcolithic
Exc	Excavated (by)
GW	Grey Ware
LH	Late Harappan
Med	Medieval
MH	Mature Harappan
Micros	Microliths
PH	Pre (Early) Harappan
TC	Terracottas

The following tables list the sites of different periods/cultures by name, district/river (the latter where it is known) with which a site is associated, name of its explorer/excavator, other cultures/periods represented at it, and its first reference. However, for some of the sites of the Early Harappan, Mature Harappan and Ganeshwar-Jodhpura cultures, which have been taken from Joshi *et al.* (1984), the name of the explorer is not given.

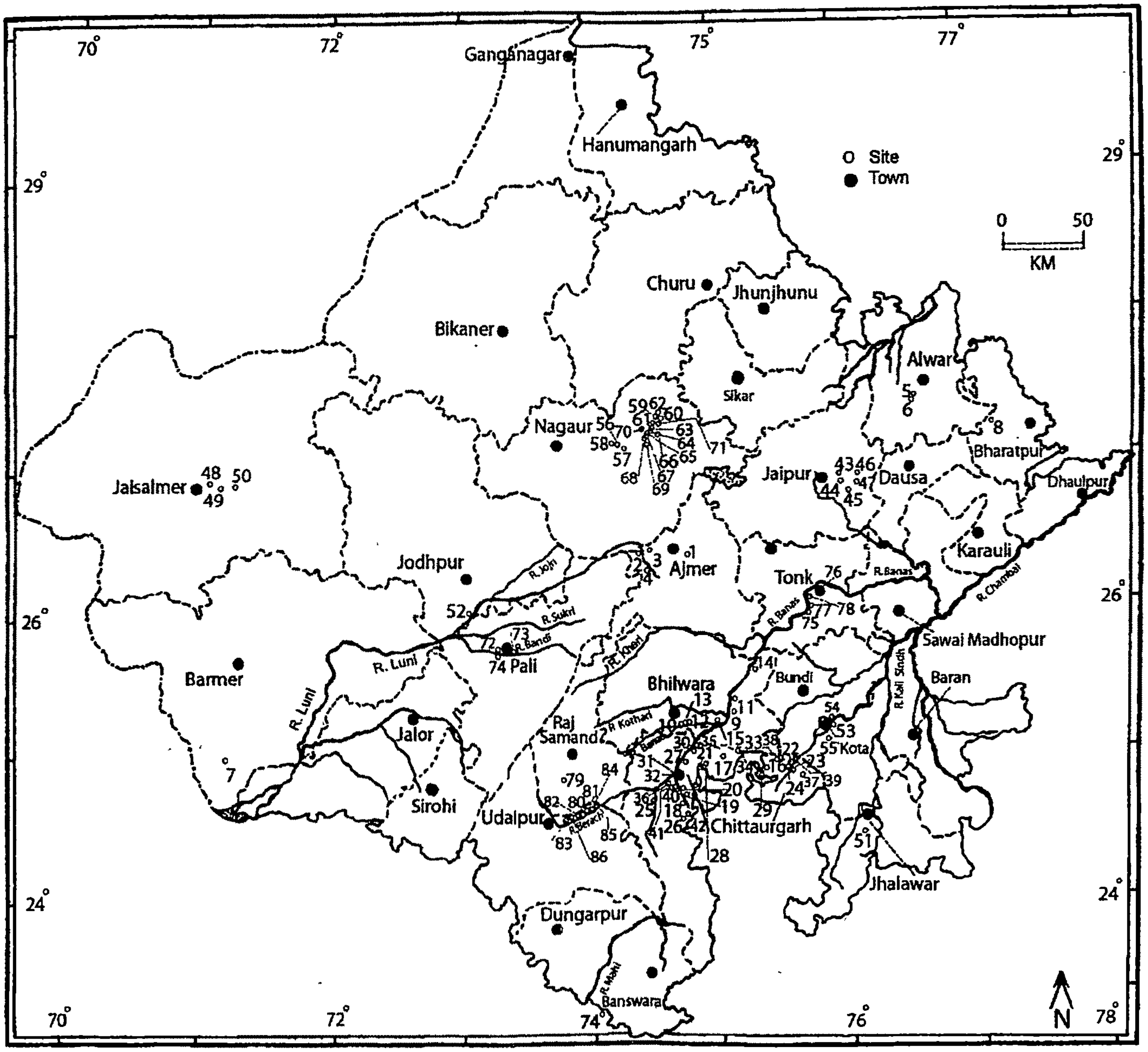

Fig. 1: Lower Palaeolithic sites in Rajasthan

Table 1: Lower Palaeolithic sites in Rajasthan

No.	Site Name	District/River	Comments/Explorer	References
01	Rupnagar	Ajmer	V.N. Misra *et al.*	IAR 1984-85: 72-73
02	Govindgarh	Ajmer/Sagarmati	And MP, V.N. Misra	IAR 1958-59: 42
03	Hokra	Ajmer/Dune	And MP, UP, Meso, Allchin *et al.*	Allchin *et al.* 1978: 120
04	Savitri Hill	Ajmer/Dune	Allchin *et al.*	Allchin *et al.* 1978: 120
05	Bhangarh	Alwar/Sanwan Nadi	K.V. Soundara Rajan	IAR 1955-56: 68
06	Garh (Neelkanth)	Alwar	R.P. Sharma *et al.*	IAR 1981-82:79
07	Aniyari (Ramji-ka-Gol)	Barmer/Quarry	V.N. Misra *et al.*	IAR 1979-80 67

No.	Site Name	District/River	Comments/Explorer	References
08	Alipur	Bharatpur	D.N. Dimri	IAR 1985-86: 69
09	Bigod	Bhilwara/Banas	And MP, V.N. Misra	IAR 1958-59: 42
10	Hamirgarh	Bhilwara/Banas	V.N. Misra	IAR 1958-59: 42
11	Jahajpur	Bhilwara/Banas	V.N. Misra	IAR 1958-59: 42
12	Mandpia	Bhilwara/Banas	V.N. Misra	IAR 1958-59: 42
13	Surupganj	Bhilwara/Banas	V.N. Misra	IAR 1958-59: 42
14	Mahuwa	Bhilwara/Banas	V.N. Misra	IAR 1958-59: 42
15	Sand	Bhilwara/Berach	V.N. Misra	IAR 1959-60: 40
16	Singoli	Chittaurgarh/Berach Gambhiri	M.N. Deshpande	IAR 1953-54. 37
17	Parsoli	Chittaurgarh/Parsoli nulla	S.R. Rao	IAR 1954-55:58
18	Kalyanpura	Chittaurgarh/Gambhiri	K.N. Puri	IAR 1956-57: 10
19	Morwan	Chittaurgarh/Gambhiri	K.N. Puri	IAR 1956-57: 10
20	Rathanjana	Chittaurgarh/Gambhiri	K.N. Puri	IAR 1956-57: 10
21	Surajpol	Chittaurgarh	S.R. Shrimali	IAR 1982-83: 67
22	Bhainsrorgarh	Chittaurgarh/Chambal	S.R. Rao	IAR 1956-57: 5
23	Sonita	Chittaurgarh/Chambal	M.N. Deshpande, S.R. Rao	IAR 1953-54: 37; 54-55: 58; 56-57: 5
24	Haripura	Chittaurgarh/ Bamani	S.R. Rao	IAR 1954-55: 58
25	Biawar	Chittaurgarh/Wagan	K.N. Puri	IAR 1956-57: 8
26	Khor	Chittaurgarh/Gambhiri	K N. Puri	IAR 1956-57: 8
27	Nagari	Chittaurgarh/Berach	S.R.Rao, K.N. Puri	IAR 1954-55: 58; 1956-57: 8
28	Bichore	Chittaurgarh/Parsoli nulla	S.R. Rao	IAR 1954-55: 58; 57-58: 45
29	Dhangadaman	Chittaurgarh/Pipla-ka-nalla	S.R. Rao	IAR 1954-55: 58
30	Tajpura	Chittaurgarh/Ruparel	S.R. Rao	IAR 1954-55: 58
31	Chittaurgarh	Chittaurgarh/Berach	And M.P, M.N. Deshpande. S.R. Rao, V.N. Misra	IAR 1953-54: 37; 1955-56: 68, 1958-59: 42
32	Chittaurgarh	Chittaurgarh/Gambhiri	M.N. Deshpande, S.R. Rao, V.N. Misra	IAR 1953-54. 37; 1955-56: 68; 1958-59: 42
33	Menal	Chittaurgarh/Berach	S.R. Rao	IAR 1957-58: 45
34	Shamaria	Chittaurgarh/Berach rivulet	S.R. Rao	IAR 1957-58: 45
35	Mandi	Chittaurgarh/Berach	S.R. Rao	IAR 1957-58: 45
36	Tukrawa 24° 52'; 74° 36'	Chittaurgarh/Berach	V.N. Misra	IAR 1962-63: 18
37	Badoli	Chittaurgarh/Chamli	S.R Rao	IAR 1956-57: 5
38	Chulia Falls	Chittaurgarh/Chambal	S.R. Rao	IAR 1956-57: 5
39	Navghat	Chittaurgarh/Chambal	S.R. Rao	IAR 1956-57: 5
40	Bhutia	Chittaurgarh/Wagan	V.N. Misra	IAR 1962-63: 18
41	Sigoh	Chittaurgarh/Kadmali	S.R. Rao	IAR 1954-55: 58
42	Nimbahera	Chittaurgarh/Kadmali	V.N. Misra	IAR 1962-63: 18
43	Ganesh Doongri	Jaipur	K.N. Dikshit	IAR 1962-63: 70
44	Bheem-ji-ki Doongri	Jaipur	P.L. Chakravarty and Vijai Kumar	IAR 1987-88:100
45	Bijiak- ki Pahari	Jaipur	P.L. Chakravarty and Vijai Kumar	IAR 1987-88:100
46	Bilwari	Jaipur	Vijay Kumar	IAR 1983-84: 71
47	Dhigaria	Jaipur	Supt Arch Udaipur	IAR 1961-62: 38
48	Bhojka	Jaisalmer	And MP< Vijay Kumar	IAR 1983-84: 71
49	Kalau	Jaisalmer	Vijay Kumar	IAR 1983-84: 71

No.	Site Name	District/River	Comments/Explorer	References
50	Moomal ki Meri	Jaisalmer	Vijay Kumar	IAR 1983-84: 71
51	Kalisindh near Jhalawar	Jhalawar	Arch Mus Raj	IAR 1970-71: 31
52	Luni 26° 1'; 73° 2'	Jodhpur/Luni	V.N. Misra	IAR 1958-59: 42
53	Kota	Kota/Chambal	V.N Misra and M. Nagar	Misra and Nagar 1963
54	Rawatbhata	Kota/Chambal	V.N. Misra and M. Nagar	Misra and Nagar 1963
55	Barni river bank	Kota/Barni	N. Vyas *et al.*	IAR 1981-82: 56
56	Rata Nadi	Nagaur/Gravel ridge	V.N. Misra *et al.*	IAR 1978-79: 31-33
57	Chhajoli	Nagaur/Gravel ridge	exc. V.N. Misra *et al.*	IAR 1978-79: 31-33
58	Jayal	Nagaur/Gravel ridge	exc. V.N. Misra *et al.*	IAR 1978-79: 31-33
59	Singi Talav	Nagaur	And M.P., Exc. V.N. Misra *et al.*	IAR 1979-80:65; 1980-81: 57; 1981-82:58-59; 1982-83: 69; 1983-84: 72; 1984-85: 73-74
60	Indola-ki-Dhani	Nagaur	And MP, Exc. V.N. Misra *et al.*	IAR 1980-81:57-59
61	Jankipura	Nagaur	And MP., V.N. Misra *et al.*	IAR 1980-81: 59
62	Amarpura	Nagaur/Quarry	V.N. Misra *et al.*	IAR 1980-81: 59
63	Surbhi Talav	Nagaur	V.N. Misra *et al.*	V.N. Misra 1995: 81
64	Kolia Hill	Nagaur/Hill Slope Deposit	V.N. Misra *et al.*	IAR 1980-81: 59; V.N. Misra 1995:81
65	Kolia Talav	Nagaur	V.N. Misra *et al.*	V.N. Misra 1995: 81
66	Bandla Talav	Nagaur	V.N. Misra *et al.*	V.N. Misra 1995: 81
67	Banthri	Nagaur/Gravel Ridge	V.N. Misra *et al.*	V.N. Misra 1995:81
68	Kathoti	Nagaur/Gravel Ridge	V.N. Misra *et al.*	V.N. Misra 1995: 81
69	Ambali	Nagaur/Gravel Ridge	V.N. Misra *et al.*	V.N. Misra 1995: 81
70	Ratau	Nagaur/Gravel Ridge	V.N. Misra *et al.*	V.N. Misra 1995: 81
71	16R (Didwana)	Nagaur	And M.P. and U.P.; exc. V.N. Misra *et al.*	IAR 1980-81: 59-61; 1981-82: 56-58; 1982-83: 68-69; V.N. Misra 1989
72	Bhadrajun	Pali/Canal cutting	V.N. Misra *et al.*	IAR 1977-78: 46
73	Pali 25° 46'; 73° 25'	Pali/Bandi	V.N. Misra	IAR 1958-59: 42
74	Singari	Pali/Guhiya	V.N. Misra	IAR 1958-59: 42
75	Deoli	Tonk/Banas	V.N. Misra	IAR 1958-59: 42
76	Tonk	Tonk/Banas	V.N. Misra	IAR 1958-59: 42
77	Banthali	Tonk/Banas	K.N. Puri	IAR 1958-59: 41-44
78	Mahuwa	Tonk/Banas	V.N. Misra	IAR 1958-59: 42
79	Nathdwara	Udaipur	H.D. Sankalia	Sankalia 1956
80	Darauli	Udaipur/Berach	V.N. Misra	IAR 1962-63: 19
81	Dhimda	Udaipur/Berach	V.N. Misra	IAR 1962-63: 19
82	Kheri 24° 38'; 73° 58'	Udaipur/Berach	V.N. Misra	IAR 1959-60: 39-40
83	Dabok	Udaipur/Berach	V.N. Misra	IAR 1959-60: 40
84	Sarjana 24° 39'; 74° 02'	Udaipur/Berach	V.N. Misra	IAR 1962-63: 19
85	Vallabhnagar	Udaipur/Berach	V.N. Misra	IAR 1962-63: 19
86	Karanpur 24° 39'; 73° 50'	Udaipur/Katara Nadi	V.N. Misra	IAR 1962-63: 19

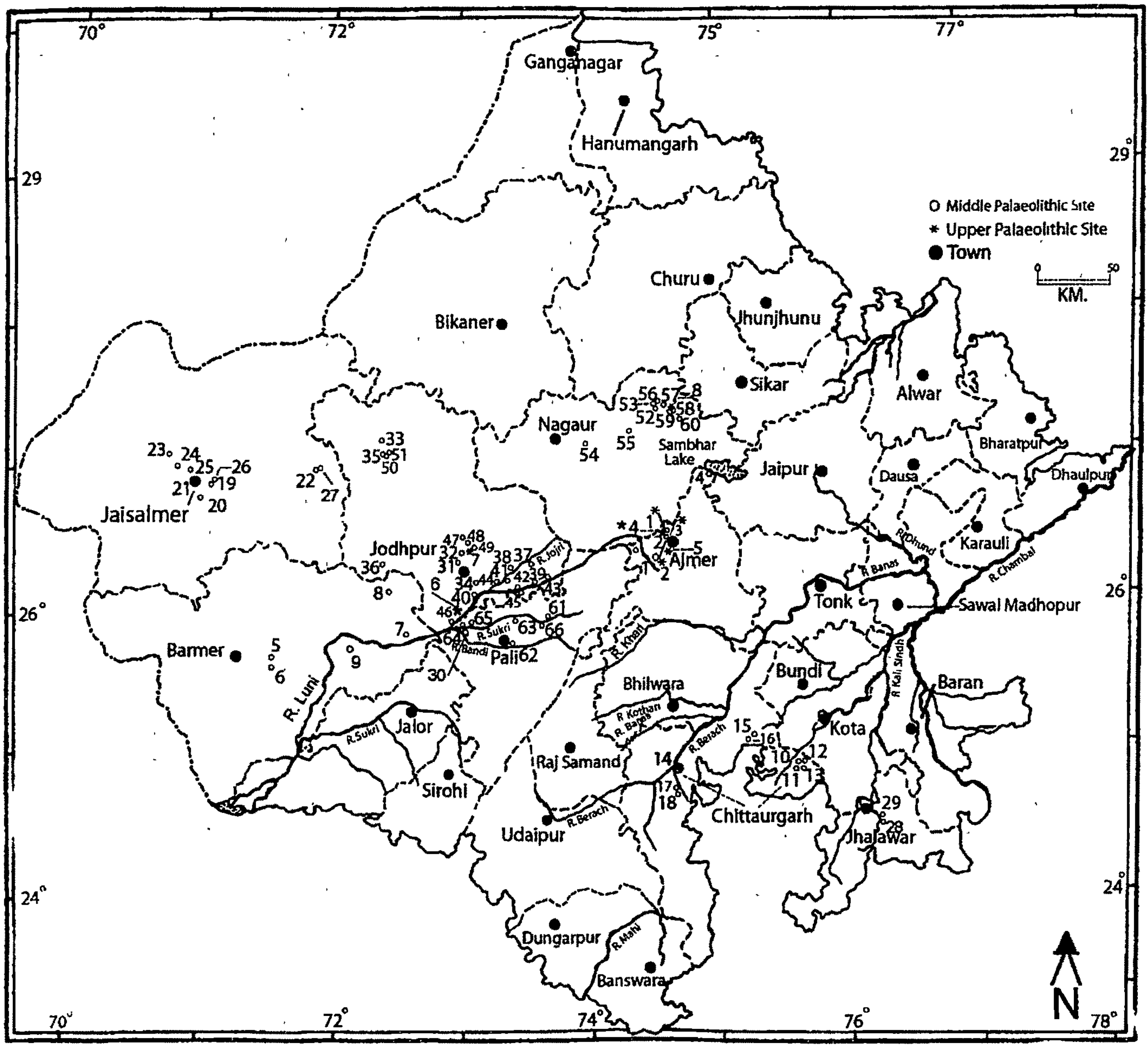

Fig. 2: Middle and Upper Palaeolithic sites in Rajasthan

Table 2: Middle Palaeolithic sites in Rajasthan

No.	Site Name	District/River	Comments/Explorer	References
1.	Govindgarh	Ajmer/Sagarmali	And LP, V.N. Misra	IAR 1958-59: 42
2.	Budha Pushkar	Ajmer	And UP and Meso, Allchin *et al.*	Allchin *et al.* 1978:158
3.	Hokra	Ajmer	And LP, Meso, Allchin *et al.*	Allchin *et al.* 1978: 126-28
4.	Sambhar Lake	Ajmer	Allchin *et al.*	Allchin *et al.* 1978: 152
5.	Barka	Barmer	N.M. Ganam	IAR 1958-59: 74
6.	Juna	Barmer	N.M. Ganam	IAR 1958-59: 74
7.	Samdari	Barmer/ Luni	V.N. Misra	IAR 1958-59: 42

No.	Site Name	District/River	Comments/Explorer	References
8.	Thob	Barmer	Allchin *et al.*	Allchin *et al.*
9.	Nakhoda temple	Barmer	V.N. Misra *et al.*	IAR 1977-78: 40
10.	Navghat	Chittaurgarh/ Chambal	And LP, S.R. Rao	IAR 1956-57: 5
11.	Sonita	Chittaurgarh/ Chambal	And LP, S.R. Rao	IAR 1956-57: 5, 8
12.	Bhainsrorgarh	Chittaurgarh/ Chambal	And LP, S.R. Rao	IAR 1956-57: 5, 8
13.	Badoli	Chittaurgarh/ Chambal	And LP, S.R. Rao	IAR 1956-57: 5, 8
14.	Chittaurgarh	Chittaurgarh/Berach	And LP, V.N. Misra	V.N. Misra 1967
15.	Chitori	Chittaurgarh	And Meso, S. R. Shrimali, ASI	IAR 1982-83: 67
16.	Jaloda	Chittaurgarh	And Meso, K.V. Soundara Rajan	IAR 1963-64: 29
17.	Hajiakheri	Chittaurgarh/ Wagan	V.N. Misra	IAR 1962-63: 18
18.	Bhutia	Chittaurgarh/ Wagan	And LP, V.N. Misra	IAR 1962-63: 18
19.	Bariyari	Jaisalmer	S.N. Rajaguru *et al.*	IAR 1989-90: 94
20.	Bhojka	Jaisalmer	V.N. Misra *et al.*	IAR 1984-85: 73
21.	Jaisalmer	Jaisalmer	V.N. Misra *et al.*	IAR 1979-80: 67
22.	Pokaran	Jaisalmer	D. Handa	IAR 1977-78: 82
23.	Sanu, 5 km N. of Sanu and 50 km N of Jaisalmer on Ramgarh road	Jaisalmer	V.N. Misra *et al.*	IAR 1984-85: 73
24.	Mokal, 3 km S of Mokal and 26 km N of Jaisalmer on Ramgarh road	Jaisalmer	V.N. Misra *et al.*	IAR 1984-85: 73
25.	Km 18 on Pokaran road	Jaisalmer	Allchin *et al.*	Allchin *et al.* 1978: 204
26.	Km 24 on Pokaran road	Jaisalmer	Allchin *et al.*	Allchin *et al.* 1978: 205
27.	Marwar Bagra	Jaisalmer	Allchin *et al.*	Allchin *et al.* 1978: 170
28.	6 km E of Pokhran on Pokaran-Phalodi road	Jaisalmer	V.N. Misra *et al.*	IAR 1979-80: 67
29.	Gajraun	Jhalawar	V.S. Wakankar	IAR 1958-59: 74
30.	Patan	Jhalawar	R. Sengupta and M.D. Khare	IAR 1963-64: 91
31.	Bana	Jodhpur	V.N. Misra *et al.*	IAR 1979-80: 67
32.	Khirwa	Jodhpur	V.N. Misra *et al.*	IAR 1976-77: 46
33.	Malhar	Jodhpur	and Meso, V.N. Misra *et al.*	IAR 1977-78: 46
34.	Mogra Hill, 24 km S of Jodhpur	Jodhpur	and Meso, V.N. Misra *et al.*	IAR 1977-78. 46
35.	Mokharia, 8 km S of Phalodi	Jodhpur	and Meso V.N. Misra *et al.*	IAR 1977-78: 46
36.	Shergah Tri-Junction	Jodhpur	and Meso V.N. Misra *et al.*	IAR 1977-78: 46
37.	Pipad 26° 22; 73° 35'	Jodhpur/Jojri	V.N. Misra	IAR 1959-60: 39-40
38.	Bisalpur	Jodhpur/Jojri	V.N. Misra	IAR 1959-60: 39-40
39.	Bhawi	Jodhpur/Luni	V.N. Misra	IAR 1958-59: 42
40.	Dundara	Jodhpur/Luni	V.N. Misra,	IAR 1959-60: 39-40
41.	Gollo	Jodhpur/Luni	V.N. Misra	IAR 1959-60: 39-40
42.	Hundgaon	Jodhpur/Luni	V.N. Misra	IAR 1959-60: 39-40
43.	Pichak	Jodhpur/Luni	V.N. Misra	IAR 1958-59: 42
44.	Shrikrishnapura	Jodhpur/Luni	V.N. Misra,	IAR 1958-59: 42
45.	Bhetanda	Jodhpur/Rena	V.N. Misra	IAR 1959-60: 39-40
46.	Luni 26° 1'; 73° 2'	Jodhpur/Luni	And LP, V.N. Misra	IAR 1958-59 42

No.	Site Name	District/River	Comments/Explorer	References
47.	Gurha	Jodhpur	Allchin *et al.*	Allchin *et al.* 1978:185
48.	Sar	Jodhpur	Allchin *et al.*	Allchin *et al* 1978:188
49.	Nagari	Jodhpur	Allchin *et al.*	Allchin *et al.* 1978:215
50.	Lordiya, 10 km SE of Phalodi; 27° 06' N: 72° 23' E	Jodhpur	Deotare *et al.*	Deotare *et al.* 1998, 2000
51.	Baridhani	Jodhpur	S.B. Bhatia and B.K. Sahu	Mohapatra *et al.* 1963
52.	Badela	Nagaur	V.N. Misra *et al.*	IAR 1982-83: 68
53.	Baklia	Nagaur	V.N. Misra *et al.*	IAR 1982-83: 68
54.	Jayal	Nagaur	V.N. Misra *et al.*	IAR 1977-78: 46
55.	Jenana	Nagaur	V.N. Misra *et al.*	IAR 1982-83: 68
56.	Mangalpura	Nagaur	V.N. Misra *et al.*	IAR 1982-83: 68
57.	Shyampura	Nagaur	V.N. Misra *et al.*	IAR 1982-83: 68
58.	16R (Didwana)	Nagaur	Exc. V.N. Misra *et al.*	IAR 1981-82: 56-58
59.	Singi Talav (Didwana)	Nagaur	Exc. V.N. Misra *et al.*	IAR 1982-83: 69
60.	Indola-ki-Dhani	Nagaur	Exc. V.N. Misra *et al.*	IAR 1980-81: 59
61.	Dhaneri	Pali	and Meso V.N. Misra	IAR 1960-61: 31; V.N. Misra 1963
62.	Pali 25° 46'; 73° 25'	Pali/Bandi	And LP, V N. Misra	IAR 1958-59: 42; V.N. Misra 1962
63.	Bandei	Pali/Guhiya	V.N. Misra	IAR 1958-59: 42; V.N. Misra 1962
64.	Singari	Pali/Guhiya	And LP, V.N. Misra	IAR 1958-59: 42; V.N. Misra 1963
65.	Danawasni	Pali/Reria	V.N. Misra	IAR 1958-59: 42, V.N. Misra 1963
66.	Sojat	Pali/Sukri	V.N. Misra	IAR 1958-59: 42; V.N. Misra 1963

Table 3: Upper Palaeolithic sites in Rajasthan

S.No.	Site Name	District/River	Comments/Explorer	References
01	Budha Pushkar	Ajmer	And MP, Meso, Allchin *et al.*	Allchin *et al.* 1978: 130-131
02	Devanagara	Ajmer	Allchin et al	Allchin *et al.* 1978: 123
03	Hokra	Ajmer	And MP, Up, Meso, Allchin *et al.*	Allchin *et al.* 1978: 155
04	Madhya Pushkar	Ajmer	Allchin *et al.*	Allchin *et al.* 1978: 158
05	Arjunpura	Ajmer	Allchin *et al.*	Allchin *et al.* 1978: 167-70
06	Mogra	Jodhpur	Allchin *et al.*	Allchin *et al.* 1978: 181-182
07	Nagri	Jodhpur	Allchin *et al.*	Allchin *et al.* 1978: 212-214
08	(16R) Didwana	Nagaur	Exc.; Misra *et al.*	IAR 1980-81: 59-61; 1981-82: 56-58; 1982-83: 68-69; Misra 1989

Table 4: Palaeolithic sites of unspecified stages in Rajasthan

S.No.	Site	District/River	Comments/Explorer	References
1	Khadeen	Barmer	Flakes of Rhyolite, V.N. Misra, *et al.*, DC	IAR 1979-80: 67
2	Garhwa	Bhilwara	B R. Meena, *et al.*, ASI	IAR 1984-85:69
3	Katar	Bhilwara	And rock shelters, B.R. Meena *et al.*, ASI,	IAR 1984-85: 67
4	Bhagawas Ahiran	Jaipur	Meso, P.L Chakravarty and Vijai Kumar Arch Mus, Raj	IAR 1987-88:100
5	Chhabra	Kota	Stone Age tools, N. Vyas and K.V. Rao, ASI	IAR 1983-84: 169
6	Gaughat	Kota	Palaeoliths, R.D. Singh *et al.* ASI	IAR 1984-85: 151
7	Nathdwara 24° 56'; 73° 52	Udaipur	Flake in situ V N. Misra	IAR 1960-61: 31

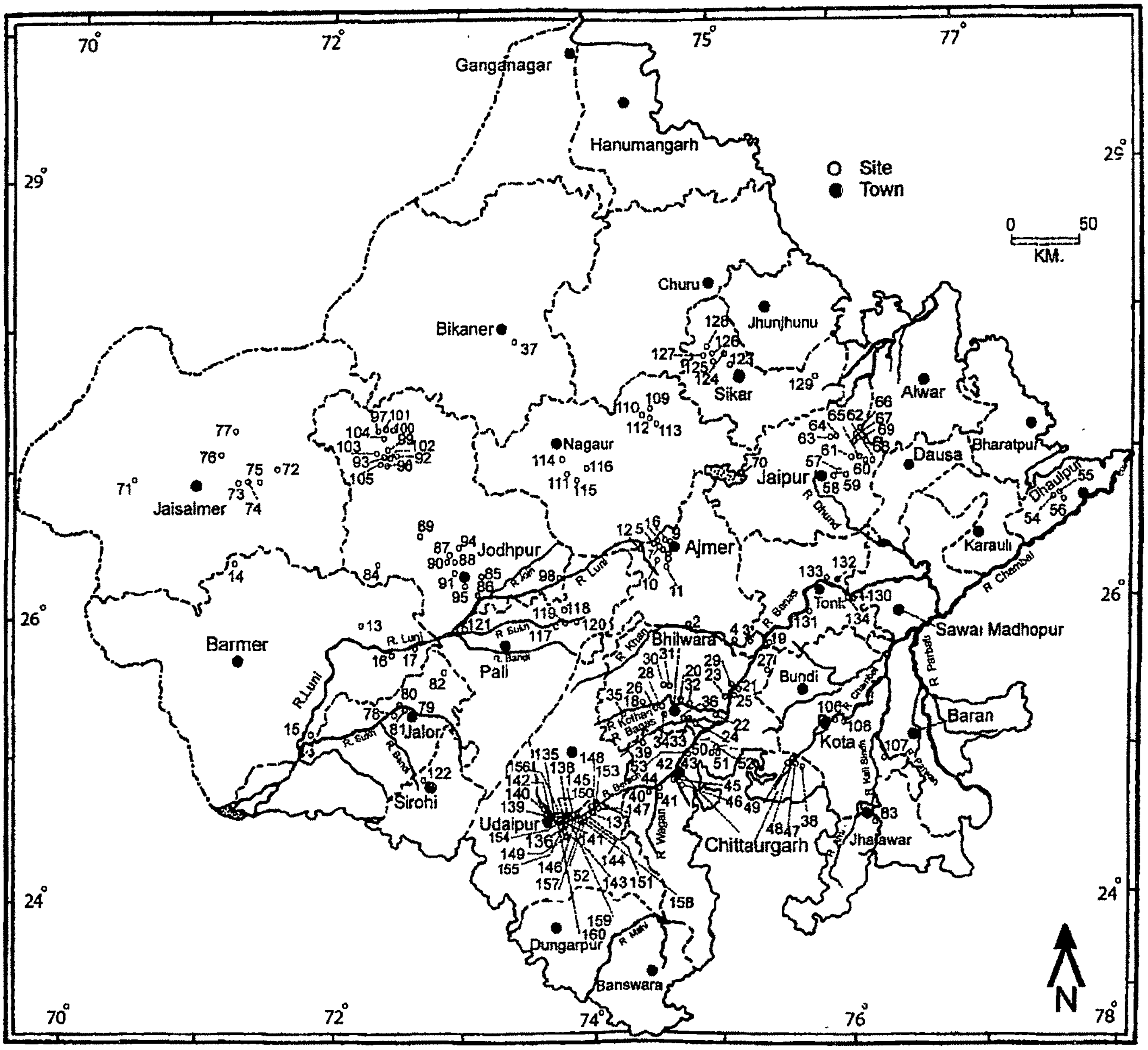

Fig. 3: Mesolithic sites in Rajasthan

Table 5: Mesolithic sites in Rajasthan

S. No.	Site Name	District/River	Comments/Explorer	References
01.	Kanhathai	Ajmer	Dir, Arch Mus Raj	IAR 1965-66: 82-83
02	Khejri	Ajmer/ Khari	ASI	IAR 1958-59: 45
03.	Chosla	Ajmer	ASI	IAR 1958-59: 45
04.	Kadera	Ajmer	ASI	IAR 1958-59: 45
05.	Nand	Ajmer	V.N. Misra *et al.*	IAR 1977-78: 46
06	Nelya	Ajmer	V.N. Misra *et al.*	IAR 1977-78: 46
07.	Hokra	Ajmer	And LP, MP and UP, Allchin *et al.*	Allchin *et al.* 1978: 155

S. No.	Site Name	District/River	Comments/Explorer	References
08.	Budha Pushkar	Ajmer	And MP, UP, Allchin *et al.*	Allchin *et al.* 1978: 132-33
09.	Madhya Pushkar	Ajmer	And UP, Allchin *et al.*	Allchin *et al.* 1978: 148
10.	Delwara	Ajmer	Allchin *et al.*	Allchin *et al.* 1978: 170
11.	Devanagara	Ajmer	Allchin *et al.*	Allchin *et al.*1978: 338
12.	Lesua	Ajmer	V.N. Misra *et al.*	IAR 1976-77: 45
13.	Pachpadra	Barmer	V.N. Misra *et al.*	IAR 1977-78: 46
14.	60 km south of Jaisalmer	Barmer	V.N. Misra *et al.*	IAR 1979-80: 67
15.	Ranodar	Barmer	V.N Misra *et al.*	IAR 1979-80: 67
16.	Tilwara	Barmer/ Luni	Exc. V.N. Misra *et al.*	IAR 1967-68: 39-41
17.	Nakhoda Temple	Barmer	Micros and MP, V.N. Misra *et al.*	IAR 1977-78: 46
18.	Bagor	Bhilwara	Exc. V.N. Misra *et al.*	IAR 1967-68: 41-42; 1968-69: 26-28; 1969-70: 32-34
19.	Deoli	Bhilwara/ Kothari	And LP, K.N. Puri	IAR 1957-58: 44-45
20.	Dhanop	Bhilwara	ASI	IAR 1970-71: 31
21.	Jalkakhera	Bhilwara/ Banas	ASI	IAR 1958-59: 45
22.	Kurias	Bhilwara/ Kothari	K.N. Puri	IAR 1957-58: 44-45
23.	Lachhmipura	Bhilwara/ Banas	ASI	IAR 1958-59: 45
24.	Mangrup	Bhilwara/ Banas	K.N. Puri	IAR 1957-58: 44-45
25.	Mali Khera	Bhilwara / Banas	R.C. Agrawala *et al.*	IAR 1979-80: 62
26.	Nagari Sthala	Bhilwara / Kothari	R.C. Agrawala *et al.*	IAR 1979-80: 62
27.	Nagariyathal	Bhilwara/ Banas	R.C. Agrawala *et al.*	IAR 1979-80: 62
28.	Nandrai	Bhilwara / Kothari	R.C. Agrawala *et al.*	IAR 1979-80: 62
29.	Sekarpura	Bhilwara/ Khari Banas	ASI	IAR 1958-59: 45
30.	Baghdana	Bhilwara/Kothari, NW edge of Bagor village	V.N. Misra	IAR 1969-70: 34
31,	Bhanvlas	Bhilwara/Kothari, 1.5 km E of Bagor site	V.N. Misra	IAR 1969-70: 34
32.	Mankyas	Bhilwara/Kothari, 3 km SE of Bagor site	V.N. Misra	IAR 1969-70: 34
33.	Mandpia	Bhilwara/Banas	V.N. Misra	IAR 1958-59: 45
34.	Pur	Bhilwara	V.N. Misra	IAR 1959:60: 40
35.	Potla	Bhilwara/Chandrabhaga	V.N. Misra	IAR 1959:60: 40
36	Sarupganj	Bhilwara/Banas	V.N. Misra	IAR 1959:60: 40
37.	5 km south on Nagaur road	Bikaner	Allchin *et al.*	Allchin *et al.* 1978: 216
38.	Badoli	Chittaurgarh	R.D. Singh *et al.*	IAR 1984-85: 151
39.	Ballu Khera	Chittaurgarh / Banas	K.N. Puri	IAR 1957-58: 44-45
40.	Bari Achnar	Chittaurgarh	K.N. Puri	IAR 1956-57: 8
41.	Biawar	Chittaurgarh	K.N. Puri	IAR 1956-57: 8
42.	Chittaurgarh	Chittaurgarh/ Berach	And LP, S.R. Rao	IAR 1955-56: 69
43.	Chittaurgarh	Chittaurgarh/ Gambhiri	And LP, S.R. Rao	IAR 1955-56: 69
44.	Deori	Chittaurgarh	K.N. Puri	IAR 1956-57: 8
45.	Khera	Chittaurgarh / Berach	S.R. Rao	IAR 1955-56: 69
46.	Sigoh	Chittaurgarh / Kadamli	And LP, S.R. Rao	IAR 1954-55: 58
47.	Tarra	Chittaurgarh	K.N. Puri	IAR 1956-57: 8

S. No.	Site Name	District/River	Comments/Explorer	References
48.	Bamini	Chittaurgarh	K.N. Puri	IAR 1956-57: 8
49.	Kalikunya	Chittaurgarh	K.N. Puri	IAR 1956-57: 8
50.	Bodiana	Chittaurgarh	N. Vyas *et al.*	IAR 1982-83: 66
51.	Chitori	Chittaurgarh	S.R. Shrimali	IAR 1982-83: 67
52.	Jaloda	Chittaurgarh	K.V. Soundara Rajan	IAR 1963-64:29
53.	Jawanpura	Chittaurgarh/Deo	K.V. Soundara Rajan	IAR 1959-60: 74
54.	Nand-ka-Pura 26° 45' 28' N: 77° 45' 22" E	Dhaulpur	Micros, early medieval; C.L. Suri *et al.*	IAR 91-92:95
55.	Tori Daniel 26° 41' 57" N: 77° 54' 55" E	Dhaulpur	Micros, early medieval; C.L. Suri *et al.*	IAR 1991-92: 96
56.	Karka Khilli 26° 46' 20" N: 78° 02' 09" E	Dhaulpur	Micros, PGW, Med. BRW pottery; C.L. Suri *et al.*	IAR 1991-92: 96
57.	Barwars	Jaipur	Also Ganeshwar culture; P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
58.	Bhagawas Ahiran	Jaipur	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
59,	Benara	Jaipur	Allchin *et al.*	Allchin *et al.*1978: 160
60.	Jhir	Jaipur	Allchin *et al.*	Allchin *et al.*: 1978: 160
61.	Beejak ki Pahari	Jaipur	Micros and rock paintings, P. L. Chakravarty Vijai Kumar	IAR 1988-89: 76
62.	Bheemji ki Dungri	Jaipur	Micros and rock paintings, K.N. Dikshit; P. L. Chakravarty and Vijai Kumar	IAR 1 962-63:70; 1988-89: 76
63.	Bramha Kund ki Dungari	Jaipur	rock paintings P.L. Chakravarty Vijay Kumar	IAR 1990-91: 60
64.	Budhi Gangaur	Jaipur	rock paintings P.L. Chakravarty Vijay Kumar	IAR 1990-91: 59
65.	Chak-Dhanota Nagal	Jaipur	P.L. Chakravarty Vijai Kumar	IAR 1987-88:100
66.	Chatarpura I	Jaipur	P.L. Chakravarty Vijai Kumar	IAR 1987-88:100
67.	Dadshahpur	Jaipur	P.L. Chakravarty Vijai Kumar	IAR 1987-88:100
68.	Ganesh Dungri	Jaipur	Micros and rock paintings P. L. Chakravarty Vijai Kumar	IAR 1988-89: 76
69.	Rairh	Jaipur	Black on cream ware R.C. Agrawala	IAR 1958-59: 74
70.	Nawa	Jaipur	V.N. Misra *et al.*	IAR 1976-77: 45
71.	Sam	Jaisalmer	V.N. Misra *et al.*	IAR 1979-80: 67
72	Loharki, near Pokaran	Jaisalmer	V.N. Misra *et al.*	Unpublished
73.	Dandar	Jaisalmer	Allchin *et al.*	Allchin *et al.*1978: 201
74.	Km 33 on Jaisalmer-Pokaran Road	Jaisalmer	Allchin *et al.*	Allchin *et al.* 1978: 206
75.	42 km on Jaisalmer-Pokaran road	Jaisalmer	Allchin *et al.*	Allchin *et al.* 1978: 206-208
76.	Kanod Playa 27° 08' N: 71° 14' E	Jaisalmer	Deotare *et al.*	Deotare *et al.* 2004: 418
77.	Mohangarh 27° 17' N: 71° 15' E	Jaisalmer	Deotare *et al.*	Deotare *et al.* 2004: 418
78.	Dabla ka Dhora	Jalor	N.M. Ganam	IAR 1967-68: 68

S. No.	Site Name	District/River	Comments/Explorer	References
79.	Jalor	Jalor	V.N. Misra *et al.*	IAR 1977-78: 46
80.	Nanawas	Jalor	V.N. Misra *et al.*	IAR 1977-78: 46
81.	Sokarna	Jalor	V.N. Misra *et al.*	IAR 1977-78: 46
82.	Marwar Bagra	Jalor	Allchin *et al.*	Allchin *et al.* 1978: 172
83.	Jhalrapatan	Jhalawar	S.P. Srivastava	IAR 1955-56: 69
84.	Belaser	Jodhpur	V.N. Misra *et al.*	IAR 1977-78: 46
85.	Bilara	Jodhpur	K.V. Soundara Rajan	IAR 1958-59: 74
86.	Bujawar	Jodhpur	V.N. Misra *et al.*	IAR 1976-77: 46
87.	Chamu	Jodhpur	V.N. Misra *et al.*	IAR 1976-77: 46
88.	Dhechu	Jodhpur	V.N. Misra *et al.*	IAR 1977-78: 46
89.	Shergarh Tri-Junction	Jodhpur	Micros and MP; V.N. Misra *et al.*	IAR 197-78: 46
90.	Khinsvar	Jodhpur	Arch Mus Raj	IAR 1956-57: 79
91.	Lordiya	Jodhpur	V.N. Misra *et al.*	IAR 1976-77: 46
92.	Mandor	Jodhpur	J.P. Joshi and T.S. Khatwani	IAR 1967-68: 68
93.	Phalodi	Jodhpur	V.N. Misra *et al.*	IAR 1976-77: 46
94.	Ummednagar	Jodhpur	K.V. Soundara Rajan	IAR 1958-59: 74
95.	Mogra Hill, 24 km S. of Jodhpur	Jodhpur	Micros and MP: V.N. Misra *et al.*	IAR 1977-78: 46
96.	Mokharia, 8 km S. of Phalodi	Jodhpur	Micros and MP: V.N. Misra *et al.*	IAR 1977-78: 46
97.	Malhar Lake	Jodhpur	Micros and MP, V.N. Misra *et al.*	IAR 1977-78: 46
98.	Bana	Jodhpur	V. N. Misra *et al.*	IAR 1979-80: 67
99.	2 km N of Phalodi, on old Malar road	Jodhpur	Micros, pott, bone Deotare *et al.*	Deotare *et al.* 1998
100.	Jamba, 8 km E of Malar lake; 27° 18' N: 72° 31' E	Jodhpur	Micros,Pott., Deotare *et al.*	Deotare *et al.* 1998, 2004
101.	Nenau, 5 km E of Malar lake	Jodhpur	Micros,Pott., Deotare *et al.*	Deotare *et al.* 1998
102.	Khinchan, 5 km E of Phalodi	Jodhpur	Micros,Pott., Deotare *et al.*	Deotare *et al.* 1998
103.	Bari Bavri, near temple, 10 km NW of Phalodi	Jodhpur	Micros, Deotare *et al.*	Deotare *et al.* 1998
104.	Hindal Gol, 5 km SW of Bap Lake	Jodhpur	Micros, Deotare *et al.*	Deotare *et al.* 1998
105.	Chhoti Bavri, 9 km NW of Phalodi	Jodhpur	Micros, Deotare *et al.*	Deotare *et al.* 1998
106	Dhaba	Kota	R.D. Singh *et al.*	IAR 1984-85: 152
107.	Kakoni	Kota/ Parwani	B.K. Thapar	IAR 1957-58: 69
108.	Rawatbhata	Kota/Chambal	V.N. Misra and M. Nagar	Misra and Nagar 1963
109.	Akora	Nagaur	N M. Ganam	IAR 1965-66: 83
110	Bari Khatu	Nagaur	N.M. Ganam	IAR 1965-66: 83
111.	Khinyala	Nagaur	V. N. Misra *et al.*	IAR 1978-79: 33
112.	Kuroli	Nagaur	N.M. Ganam	IAR 1965-66: 83
113	Didwana	Nagaur	V.N. Misra *et al.*	Unpublished
114.	Langer	Nagaur	N.M. Ganam	IAR 1964-65. 76

S. No.	Site Name	District/River	Comments/Explorer	References
115.	47 km south of Nagaur on Nagaur-Jodhpur road	Nagaur	V.N. Misra *et al.*	IAR 1979-80: 67
116.	Silanwad	Nagaur	N.M. Ganam	IAR 1967-68: 68
117.	Sojat	Pali	And MP: V.N. Misra	IAR 1959-60: 40
118.	Dhaneri	Pali	And MP: V.N. Misra	IAR 1959-60: 40
119.	Jadan	Pali	L.S. Leshnik	Leshnik 1968: 295-310
120.	Kanawas	Pali	L.S. Leshnik	Leshnik 1968: 295-310
121.	Khairla	Pali	Allchin *et al.*	Allchin *et al.* 1978: 173
122.	Chandravati	Sirohi/ Banas	R.N. Mehta *et al.*MSU .Baroda	IAR 1977-78: 49
123.	Malyali	Sikar/ Kanatali	R.C. Agrawala Vijai Kumar	IAR 1978-79: 20; 1979-80:64
124.	Nayavali	Sikar/ Kantli	R.C. Agrawala Vijai Kumar	IAR 1978-79: 20; 1979-80: 64
125.	Nijhara	Sikar	P.L. Chakravarty Vijai Kumar	IAR 1987-88: 101
126.	Papra	Sikar	P. L. Chakravarty Vijai Kumar	IAR 1988-89: 76
127.	Puranavas	Sikar	P.L. Chakravarty Vijai Kumar	IAR 1987-88: 101
128.	Ganeshwar 37° 40' N 75° 51' 30" E	Sikar	Exc. Also Ganeshwar Culture; P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 101
129.	9 km E of Nim ka Thana	Sikar	Allchin *et al.*	Allchin *et al.* 1978: 165
130.	Baithola/Bethola	Tonk/ Banas	ASI	IAR 1958-59: 45
131.	Bharni	Tonk/ Banas	ASI	IAR 1958-59: 45
132.	Chokri	Tonk/ Banas	ASI	IAR 1958-59: 45
133.	Deopura	Tonk	BRW	IAR 1958-59: 45
134.	Sundela	Tonk/ Banas	ASI	IAR 1958-59: 45
135.	Subhagpura	Udaipur/Ahar	K.N. Puri	IAR 1956-57: 6,8
136.	Mander	Udaipur/Berach	K.N. Puri	IAR 1956-57: 6,8
137.	Akodra	Udaipur /Berach	V.N. Misra	IAR 1962-63: 18
138.	Balathal	Udaipur/Berach	V.N. Misra	IAR 1962-63:18
139.	Bara Bedla	Udaipur/Ahar	K.N. Puri	IAR 1956-57: 8
140.	Bedla 24° 38'; 73° 42'	Udaipur/ Ahar	V.N. Misra	IAR 1962-63: 18
141.	Bhimal 24° 40'; 73° 58'	Udaipur/ Katara Nadi	V.N. Misra	IAR 1962-63: 18
142.	Bhuwana 24° 37'; 73° 43'	Udaipur/ Ahar	V.N. Misra	IAR 1962-63: 18
143.	Bichri 24° 35'; 73° 52'	Udaipur	K.N. Puri	IAR 1956-57: 8
144.	Bijana	Udaipur	K.N. Puri	IAR 1956-57: 8
145.	Dabok 24° 37'; 73° 54'	Udaipur	K N. Puri	IAR 1956-57: 8
146.	Dhaba	Udaipur/ Berach	V.N. Misra	IAR 1962-63: 19
147.	Dhamania 24° 42'; 74° 05'	Udaipur/ Berach	V.N. Misra	IAR 1962-63: 19
148.	Gamanpura 24° 41'; 74° 03'	Udaipur/ Berach	V.N. Misra	IAR 1962-63: 19
149.	Garua/Garha	Udaipur	K N. Puri/V N. Misra	IAR 1956-57: 8; 1959-60: 40

S. No.	Site Name	District/River	Comments/Explorer	References
150.	Gotipa 24° 43'; 73° 59'	Udaipur/ Berach	V.N. Misra	IAR 1962-63: 19
151.	Intali	Udaipur	K.N. Puri	IAR 1956-57: 8
152.	Karanpur 24° 39': 73° 50'	Udaipur/Katara Nadi	K.N. Puri/ V.N. Misra	IAR 1956-57: 8; 1959-60: 40
153.	Mordai	Udaipur	K.N. Puri	IAR 1956-57: 8
154.	Namri 24° 40'; 73° 58'	Udaipur/ Katara Nadi	V.N. Misra	IAR 1962-63: 19
155.	Paota 24° 42'; 73° 58'	Udaipur/Katara Nadi	V.N. Misra	IAR 1962-63: 19
156.	Salera 24° 41'; 73° 56'	Udaipur/Katara Nadi	V.N. Misra	IAR 1962-63: 19
157.	Dhimra 24° 38': 74° 01'	Udaipur/Berach	V.N. Misra	IAR 1962-63: 19
158.	Sarjana 24° 39': 74° 02'	Udaipur/Berach	V.N. Misra	IAR 1962-63: 19
159.	Hiaro 24° 36': 73° 53'	Udaipur/Berach	V.N. Misra	IAR 1962-63: 19
160.	Jaggannathpura	Udaipur/Ahar	V.N. Misra	IAR 1959-60: 40

Table 6: Painted rockshelters in Rajasthan

S. No.	Site Name	District/River	Comments/Explorer	References
01	Modi Dungri	Alwar	Protohistoric, P.L. Chakravarty and Vijay Kumar	IAR 1990-91: 59
02	Samda	Alwar	Protohistoric, P.L. Chakravarty and Vijay Kumar	IAR 1990-91: 59
03	Harsora	Alwar	Mesolithic rock paintings, P.L. Chakrvarty and Vijay Kumar	IAR 1990-91: 59
04	Kali Pahari	Alwar	Mesolithic rock paintings, P.L. Chakravarty and Raj Kumar	IAR, 190-91: 59
05	Darr	Bharatpur	Dir, Arch Mus Raj	IAR 1965-66: 83
06	Mundhpur	Bharatpur	ASI	IAR 1979-80: 68
07	Bhimat	Bhilwara	J. Narayana	IAR 1987-88: 142
08	Gopichand ka Chhajja	Bhilwara	J. Narayana	IAR 1987-88: 142
09	Hathi Tat	Bhilwara	J. Narayana	IAR 1987-88: 142
10	Jharian	Bhilwara	J. Narayana	IAR 1987-88: 142
11	Jognimata	Bhilwara	J. Narayana	IAR 1987-88: 142
12	Khoki	Bhilwara	J. Narayana	IAR 1987-88: 142
13	Medaki Mahadeva	Bhilwara	J. Narayana	IAR 1987-88: 142
14	Menal	Bhilwara	J. Narayana	IAR 1987-88: 142
15	Bijak-ki-Pahari	Jaipur	K.N. Dikshit/Prehistoric paintings and micros,P.L. Chakrvarty and Vijay Kumar	IAR 1962-63: 70; 1988-89: 76
16	Bheemji-ki-Dungri	Jaipur	Painted shelters and micros, K.N. Dikshit; P.L. Chakravarty and Vijay Kumar	IAR 1962-63: 70; 1988-89: 76
17	Ganesha-Doongri	Jaipur	K.N. Dikshit; Prehistoric paintings and micros, P.L. Chakravarty and Viay Kumar	IAR 1962-63: 70; 1988-89: 76

S. No.	Site Name	District/River	Comments/Explorer	References
18	Bhainsawal	Jaipur	Mesolithic paintings P.L.Chakravarty and Vijay Kumar	IAR 1990-91: 59
19	Bramha kund-ki-Dungri	Jaipur	Mesolithic paintings, P.L. Chakravarty and Vijay Kumar	IAR 199-91: 60
20	Budhi Gangaur	Jaipur	Mesolithic paintings, P.L. Chakravarty and Vijay Kumar	IAR 1990-91: 59
21	Bainari Bandh	Jaipur	Mesolitic paintings, P.L. Chakravarty and Vijay Kumar	IAR 1990-91: 59
22	Kishan Bilas	Kota/Bilas	128 shelters, 36 with paintings; N. Vyas *et al.*	IAR 1981-82: 56
23	Kapildhara	Kota/Barni	58 rock shelters, 17 with paintings; N. Vyas *et al* ASI	IAR 1981-82: 56
24	Desuri	Pali	Protohistoric , petroglyphs and engravings, P.L. Chakravarty and Vijay Kumar	IAR 1990-91: 60
25	Nadol	Pali	Protohistoric paintings and Petroglyphs, P.L. Chakravarty and Vijay Kumar	IAR 1990-91: 60
26	Narlai	Pali	Protohistoric paintings, pottery, micros, P.L. Chakravarty and Vijay Kumar	IAR 1990-91: 60

Table 7: Ahar culture sites in Rajasthan

S.No.	Site Name	District/River	Comments/Explorer	References
1.	Reach Mahal	Ajmer	BRW, and other wares; etc. B.R. Meena *et al.*, ASI	IAR 1984-85: 67
2.	Dantri	Ajmer	BRW, BG, B.R. Meena *et al.*	IAR 1984-85: 67:
3.	Chosla 25° 50' N: 75° 20 E'	Ajmer/Banas	PGW; Painted BRW, NBP; Micros, ASI	IAR 1958-59: 45
4.	Samelia 26° 03' N: 75° 00'E	Ajmer/Dai	BRW, ASI	IAR 1958-59: 45
5.	Unkhalia	Bhilwara	Chalco, BRW GW, BGW and RW, and early medieval, B.R. Meena, ASI	IAR 1984-85:69
6.	Juna Amarpura 25° 30' N: 75° 06' E	Bhilwara/Banas	BRW R.C. Agrawala, *et al.*	IAR 1979-80: 62
7.	Joashia 25° 12' 74° 32'	Bhilwara/Banas	BRW K.N. Puri, ASI, ASI	IAR 1957-58: 44-45
8.	Hurda 25° 54' 75° 41'	Bhilwara/Khari	BRW R.C. Agrawala *et al.*	IAR 1979-80: 62
9.	Tikari Khera 25° 20' N: 74° 13'	Bhilwara/Kothari	BRW R.C. Agrawala *et al.*	IAR 1979-80: 62
10.	Duria 25° 12' 74° 30'	Bhilwara/Banas	BRW and Micros, K.N. Puri, ASI	IAR 1957-58: 44-45
11.	Giga Khera 25° 15' N: 74° 55' E	Bhilwara/Banas	BRW and Micros, , K.N. Puri, ASI	IAR 1957-58: 44-45
12.	Kumaria 25° 15' N: 74° 42' E	Bhilwara/Banas	BRW and Micros, K.N. Puri, ASI	IAR 1957-58: 44-45
13.	Amli 25° 46' N. 75° 07' E	Bhilwara/Khari	BRW ASI	IAR 1958-59: 45
14.	Bihara 25° 39' N: 75° 14' E	Bhilwara/Banas	BRW ASI	IAR 1958-59: 45

S.No.	Site Name	District/River	Comments/Explorer	References
15	Kotri 25° 42' N: 75° 03'	Bhilwara/Khari	BRW ASI	IAR 1958-59: 45
16.	Pander 25° 39' N: 75° 11' E	Bhilwara/Khari	BRW ASI	IAR 1958-59. 45
17.	Dhelana 25° 19' N: 74° 51'	Bhilwara/Kothari	BRW , K.N. Puri, ASI	IAR 1957-58: 44-45
18.	Kadu Kota 25° 22' N: 74° 45' E	Bhilwara/Kothari	BRW , K.N. Puri, ASI	IAR 1957-58: 44-45
19.	Ojena/Ojiyana 25° 53' N: 74° 21' E	Bhilwara/Khari	BRW - other wares, B.R. Meena *et al.*	IAR 1984-85: 68
20.	Bhilwara	Bhilwara	Arch Mus Raj	IAR 1983-84: 71
21.	Lachura 26° 24' N: 77° 53' E	Bhilwara	Arch Mus Raj, Exc. B.R. Meena	IAR 1983-84: 71; 1998-99:138-141
22.	Kachula	Bhilwara	Arch Mus Raj,	IAR 1983-84: 71
23.	Junikheda	Bhilwara	B.R. Meena *et al.*	IAR 1984-85: 67
24.	Malikhera 25° 16' N: 75° 01' E	Bhilwara/Banas	Arch Mus Raj	Hooja 1988
25.	Aguncha 25° 45' N: 74° 64' E	Bhilwara/Mansi	D.L. Nagarch	Nagarch and Trivedi 1979
26.	Khatwara 25° 15' N: 75° 00' E	Bhilwara/Banas	Arch Mus Raj	Hooja 1988
27.	Nagriyasthal	Bhilwara/Banas	Arch Mus Raj	Hooja 1988
28.	Nandrai 25° 20' N: 75° 02' E	Bhilwara/Banas	Arch Mus Raj	Hooja 1988
29.	Bamania	Chittaurgarh	BRW S.R. Shrimali ASI	IAR 1982-83: 67
30.	Bansen 24° 44' N: 74° 27' E	Chittaurgarh/Wagan	Chalco and BRW , K.N. Puri, ASI	IAR 1956-57: 8; Misra 1967
31.	Hingwanio 24° 46' N: 74° 17' E	Chittaurgarh/Berach	Chalco and BRW , K.N. Puri, ASI	IAR 1956-57: 8
32.	Hironji ka Khera 24° 44' N: 74° 17' E	Chittaurgarh/Wagli	BRW and micros, K.N. Puri, ASI	IAR 1956-57: 8
33.	Keli 24° 39' N: 74° 47' E	Chittaurgarh/Gambhiri	Chalco and BRW , K.N. Puri, ASI	IAR 1956-57. 8
34.	Khor 24° 49' N: 74° 39' E	Chittaurgarh/Gambhiri	BRW and micros, K.N. Puri, ASI	IAR 1956-57: 8
35.	Nangauli 24° 39' N: 74° 18' E	Chittaurgarh/Wagli	BRW, K.N. Puri, ASI	IAR 1956-57: 8
36.	Rashmi	Chittaurgarh	BRW, Arch Mus Raj	IAR 1966-67: 30
37.	Sirdi 24° 55' N: 74° 42' E	Chittaurgarh/Berach	BRW, K.N. Puri, ASI	IAR 1956-57. 8; V.N. Misra: 1967
38.	Umand 24° 46' N: 74° 18' E	Chittaurgarh/Berach	BRW, K.N. Puri, ASI; V.N. Misra	IAR 1956-57: 8; 1962-63: 18
39.	Undala 24° 48' N: 74° 25' E	Chittaurgarh/Berach	BRW and micros, K.N. Puri,	IAR 1956-57: 8
40.	Viroli 24° 43' N: 74° 17' E	Chittaurgarh/Wagli	BRW and micros, K.N. Puri,	IAR 1956-57: 8
41.	Acharya 24° 26' N: 74° 51'3 E	Chittaurgarh/Shiva nullah	BRW R.C. Agrawala *et al.*	IAR 1979-80: 62
42	Gilund 25° 01' N. 74° 15' E	Chittaurgarh/Banas (now Rajsamand)	BRW, K.N. Puri, ASI; Exc. B.B. Lal 1959-60; Shinde and Possehl 2000-2003	IAR 1957-58 44-45; IAR 1959-60. 41-46; Possehl *et al* 2004

S.No.	Site Name	District/River	Comments/Explorer	References
43.	Chhatri Khera 25° 00' N: 74° 14' E	Chittaurgarh/Banas	BRW, K.N. Puri, ASI	IAR 1957-58: 44-45
44.	Meroli 25° 04' N: 74° 25' E	Chittaurgarh/Banas	BRW , K.N. Puri, ASI	IAR 1957-58: 44-45
45.	Pachimto 25° 01' N: 74° 12' E	Chittaurgarh/Banas	BRW, K.N. Puri, ASI	IAR 1957-58: 44-45
46.	Purani Marmi 25° 06' N: 74° 25' E	Chittaurgarh/Banas	BRW and Micros, K.N. Puri, ASI	IAR 1957-58: 44-45; Misra *et al.* 1993
47.	Uncha 25° 08' N: 74° 27' E	Chittaurgarh/Banas	BRW and Micros , K.N. Puri, ASI	IAR 1957-58: 44-45
48.	Juna Amodo	Chittaurgarh/Gambhiri	BRW R.C. Agrawala *et al.*	IAR 1979-80: 62
49.	Juni Ordi 24° 47'N; 74° 42' E	Chittaurgarh/Gambhiri	BRW R.C. Agrawala *et al.*	IAR 1979-80: 62
50.	Nagari	Chittaurgarh/ Gambhiri	BRW R.C. Agrawala *et al.*	IAR 1979-80: 62
51.	Rajalgarh (Choti Sadari) 24° 23'N; 74° 43' E	Chittaurgarh/lake	BRW R.C. Agrawala *et al.*	IAR 1979-80: 62; Hooja 1988
52.	Gomana 24° 23'N; 74° 44' E	Chittaurgarh/Jakam	BRW R.C. Agrawala *et al.*	IAR 1979-80: 62
53.	Rawaliya/ Raolia 24° 43'N; 74° 38' E	Chittaurgarh/Moti nala/ Mulya nullah	BRW R.C. Agrawala *et al.*	IAR 1979-80: 62
54.	Bansen 24° 44' N; 74° 29' E	Chittaurgarh/Wagan	Painted BRW, V.N. Misra, DC	IAR 1962-63: 18; Misra 1967
55.	Champakheri 24° 42' N; 74° 32' E	Chittaurgarh/Wagan	Painted BRW , V.N. Misra, DC	IAR 1962-63: 18; Misra 1967
56.	Alod 24° 42' N; 74° 32' E	Chittaurgarh/Wagan	Rima Hooja	Hooja 1988
57.	Amoda 24° 42' N; 74° 32' E	Chittaurgarh/Gambhiri	Rima Hooja	Hooja 1988
58.	Thikriya 24° 47' N; 74° 40' E	Chittaurgarh/Gambhiri	Rima Hooja	Hooja 1988
59.	Dumduma 24° 56' N; 74° 42' E	Chittaurgarh/Berach	Rima Hooja	Hooja 1988
60.	Juna Orwadia 24° 32' N; 74° 29' E	Chittaurgarh/Wagan	Rima Hooja	Hooja 1988
61.	Juni Begun 25° 00' N; 75° 01' E	Chittaurgarh/Bamani	Arch Mus Raj	Hooja 1988
62.	Chittoriyan Magari 24° 26' N; 74° 26' E	Chittaurgarh/Karju	R.C. Agrawala	Agrawala 1979
63.	Mewasa 24° 44' N; 74° 46' E	Chittaurgarh/Gambhiri	Rima Hooja	Hooja 1988
64.	Morwan 24° 37' N; 74° 20' E	Chittaurgarh/Wagan	Rima Hooja	Hooja 1988
65.	Palod 24° 33' N; 74° 20' E	Chittaurgarh/Wagan	Rima Hooja	Hooja 1988
66.	Phinodara 24° 32' N; 74° 37' E	Chittaurgarh/Pind	R C. Agrawala	Agrawala 1979
67	Pind 24° 30' N; 74° 30' E	Chittaurgarh/Pind	R.C. Agrawala	Agrawala 1979
68.	Punawali	Chittaurgarh/Banas	Arch Mus Raj	Hooja 1988
69.	Satkhanda 24° 45' N; 74° 39' E	Chittaurgarh/Gambhiri	Rima Hooja	Hooja 1988

S.No.	Site Name	District/River	Comments/Explorer	References
70.	Donder Khera 26° 42' N.; 77° 42' 45" E.	Dhaulpur/Medki and Maghi	BRW, PGW, BSW, early medieval and historical, Jaina and Brahmanical sculptures, C.L. Suri *et al.* ASI	IAR 1964-65: 35; 1991-92: 94
71.	Kolwa 26° 46' 18" N.; 77 49' 23" E.	Dhaulpur	BRW PGW and medieval, C.L. Suri *et al.*, ASI	IAR 1991-92: 94
72.	Aspur 23° 57' N.;74° 05' E	Dungarpur/Som	BRW R.C. Agrawala *et al.*	IAR 1979-80: 62
73.	Koliya	Dungarpur/Som	BRW R.C. Agrawala *et al.*	IAR 1979-80: 62
74.	Karelia 23° 59' N.;73° 58' E	Dungarpur/Som	Arch Mus Raj	Agrawala 1981: 62
75.	Depura/Depore	Dungarpur/Som	Arch Mus Raj	Agrawala 1981:62
76.	Ramagaon	Dungarpur/Som	Arch Mus Raj	Agrawala 1981:62
77.	Rangeli	Dungarpur/Jakam	Arch Mus Raj	Hooja 1988
78.	Gondi 26° 45' N.;75° 40' E	Jaipur/Bandi	PGW, NBP, BRW EH ASI	IAR 1958-59: 45
79.	Agtari 26° 29' N: 75° 15' E	Jaipur/Mashi	BRW Painted BRW ASI	IAR 1958-59: 45
80.	Dayarampur	Jaipur		IAR 1970-71: 91
81.	Hathipura	Jaipur	Arch Mus Raj	Hooja 1988
82.	Banthali 25° 53' N: 75° 33' E	Tonk/Banas	BRW ASI	IAR 1958-59: 45
83.	LanLank 26	Tonk/Banas	BRW and EH ASI	IAR 1958-59: 45
84.	Ramkishanpur 26° 22' N: 75° 45' E	Tonk/ Mashi	BRW ASI	IAR 1958-59: 45
85.	Naner 26° 12' N: 75° 39' E	Tonk/Sodra	BRW ASI	IAR 1958-59: 45
86.	Deopura 26° 08' N: 75° 54' E	Tonk/Banas	BRW, micros, ASI	IAR 1958-59: 45
87.	Ahar 24° 35' N: 74° 44 E'	Udaipur/Ahar	Exc. R.C. Agrawala 1952; 1953-54, 54-55; H.D. Sankalia *et al.* 1961-62	IAR 1954-55:14-15; 55-56: 11; 61-62: 45-50
88.	Darauli 24° 37'N; 73° 58'E	Udaipur/Berach	Chalco and BRW , K.N. Puri, ASI	IAR 1956-57: 8
89.	Fachar 24° 38'N; 73° 58'E	Udaipur/Berach	BRW and micros, K.N. Puri, ASI	IAR 1956-57: 8
90.	Joera 24° 44' N; 74° 07' E	Udaipur/Berach	BRW and micros, K.N. Puri, ASI	IAR 1956-57: 8
91.	Sialpura 24° 40 N; 73° 41' E	Udaipur/Ahar	BRW amd micros, K.N. Puri,	IAR 1956-57: 8
92.	Tarawat 24° 42' N; 74° 06'E	Udaipur/Berach	BRW, Micros, K.N. Puri, ASI	IAR 1956-57: 8
93.	Balathal 24° 43' N; 74° 01' E	Udaipur/Berach	Exc. V.N. Misra *et al.* 1994-2000; Ahar culture and Iron Age	IAR 193-94: 93-97; 1995-96: 64-70; 1996-97: 90-100; 1997-98: 145-153; Misra *et al.* 1995, 1997
94.	Goga Thala 25° 04' N; 74° 03'E	Udaipur/Banas	BRW and Micros, K.N. Puri, ASI	IAR 1957-58: 44-45
95.	Kotharia 24° 57' N; 73° 53'E	Udaipur/Banas	BRW, K.N. Puri, ASI	IAR 1957-58: 44-45
96.	Mangas 25° 04' N; 74° 13'E	Udaipur/Banas	BRW, K.N. Puri, ASI	IAR 1957-58: 44-45
97.	Bespura 24° 12' N; 73° 55'E	Udaipur/Gomati	BRW R.C. Agrawala *et al.*	IAR 1979-80: 65

S.No.	Site Name	District/River	Comments/Explorer	References
98.	Jhadol	Udaipur/Gomati/Tidi	BRW R.C. Agrawala *et al.*	IAR 1979-80: 65; Agrawal 1981: 62
99.	Toraniya	Udaipur/Gomati	BRW R.C. Agrawala *et al.*	IAR 1979-80: 65
100.	Utpuriya	Udaipur/Gomati	BRW R.C. Agrawala *et al.*	IAR 1979-80: 65
101.	Kheri 24° 38' N; 73° 56'E	Udaipur/Katara Nadi	Painted BRW, V.N. Misra, DC	IAR 1962-63: 19
102.	Rupawali 24° 41' N; 74° 03'E	Udaipur/Berach	V.N. Misra	IAR 1962-63
103.	Depore/Depura	Udaipur/Som	BRW R.C. Agrawala *et al.*	IAR 1979-80: 65
104.	Bedla	Udaipur/Ahar	J.S. Kharakwal and V.S Shinde	IAR 1997-98: 154
105.	Devri Doonka 24° 51' N; 73° 53' E	Udaipur/stream	Rima Hooja	Hooja 1988
106.	Juni Kochhli 24° 57' N; 73° 54' E	Udaipur/Banas	Rima Hooja	Hooja 1988
107.	Kalyanpur 24° 00' N; 73° 45' E	Udaipur/Som	Rima Hooja	Hooja 1988
108.	Karanpur 24° 39' N; 73° 57' E	Udaipur/Katara Nadi	Rima Hooja	Hooja 1988
109.	Menar 24° 37' N; 74° 07' E	Udaipur/Berach	Arch Mus Raj	Hooja 1988
110.	Thepsthal	Udaipur/Sabarmati	Arch Mus Raj	Hooja 1988
111.	Bamanhera (Bamera) 24° 59' N; 73° 53'E	Udaipur/Banas	Rima Hooja	Hooja 1988: 208

Note: There are some discrepancies, contradictions and lack of clarity in respect of a few sites with regard to the spelling of their names, their cultural affiliation, and their association with rivers. The sources in which the sites in question are listed are IAR 1979-80: 62-65; R.C. Agrawala 1981: 62, and Rima Hooja: 1988). The major discrepancies are as follows:

1. Hooja (1988: 166) mentions the site of Ramagaon on the Som river in Dungarpur Dist and cites R.C. Agrawala 1981: 62 as source. But there is no mention of this site in Agrawala's article.
2. IAR (65) mentions Bespur, Depore, Jhodl and Utpuriya. Apparently the same sites in Agrawala are spelt as Bespura, Depura, Jhadol,and Utpuria. Hooja mentions Bespur, Jhadol and Utpuria. She does not mention Depore/Depura at all.
3. Agrawala and Hooja mention Jhadol on the Tidi but the IAR (of which the source is Agrawala only) mentions the same site on the Gomati.
4. IAR (62) mentions Mali Khera, Nagari Sthala, Nagariyathal and Nandrai as microlithic sites but Hooja mentions Malikhera, Nagriyasthan (not Nagari Sthala or Nagariyathal) and Nandrai as Ahar culture sites.
5. IAR (62) mentions Rawaliya on the Mulya nullah, but Hooja lists Rawalia (Raolia) on the Moti Nala.
6. IAR (62) lists Choti Sadari (Rajalgarh) on the Jakam but in Hooja's list Rajalgarh is located on a lake.

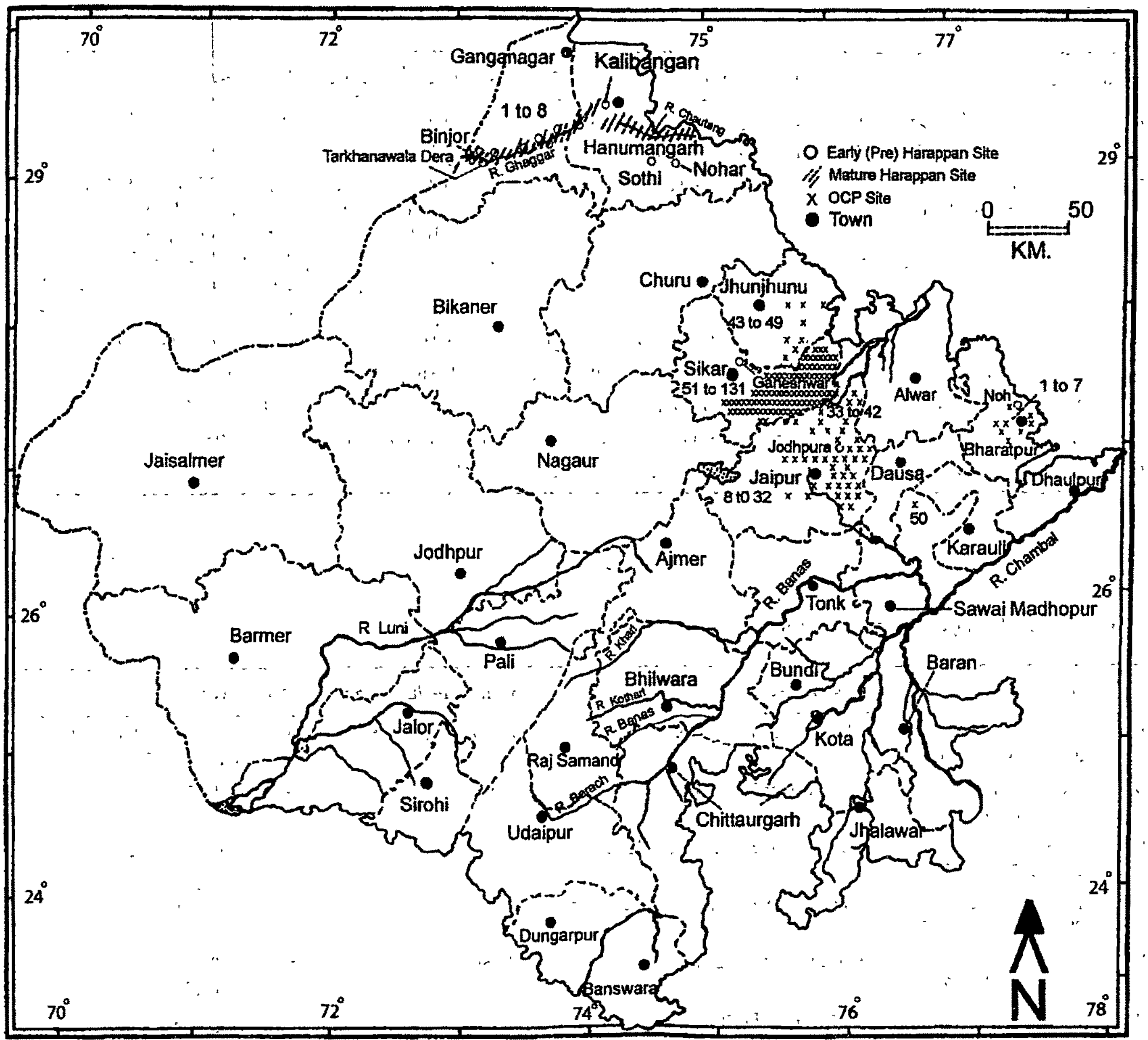

Fig. 4: Early and Mature Harappan and OCP sites in Rajasthan

Table 8: Early (Pre-Mature) Harappan sites in Rajasthan

S.No.	Site Name	District/River	Comments/Explorer	References
01	Bugian 29° 22' N: 73° 38' E	Ganganagar/Hanumangarh/Ghaggar	and MH	Joshi *et al.* 1984: 520
02	Jogiasosn 29° 10' N: 74° 45' E	Ganganagar/Hanumangarh/Ghaggar	and MH	Joshi *et al.* 1984: 520
03	Kalibangan 29° 29' N: 74° 08' E	Hanumangarh/Ghaggar	and MH, L.P. Tessatori; Aurel Stein; A. Ghosh; Exc. BB. Lal & BK. Thapar	Ghosh 1952; IAR 1960-61:31-32; 1961-62:39-44; 1962-63:20-31; 1963-64:30-39; 1964-65:35-39; 1965-66:38-41; 1966-67:31-33; 1967-68:42-45; 1968-69:28-32; Lal *et al.* 2003
04	Karoti 29° 10' N: 74° 52' E	Ganganagar/Hanumangarh/Ghaggar	and MH	Joshi *et al.* 1984: 520
05	Nohar 29° 10' N: 74° 45' E	Ganganagar/Hanumangarh/Ghaggar	A. Ghosh	Ghosh 1952
06	R.D. 89 29° 12' N: 73° 04' E	Ganganagar/Hanumangarh/Ghaggar		Joshi *et al.* 1984: 520
07	Sherpura 29° 10' N: 75° 15' E	Ganganagar/Hanumangarh/Ghaggar	and MH, A. Ghosh	Ghosh 1952
08	Sothi 29° 11' N: 74° 50' E	Ganganagar/Hanumangarh/Ghaggar	A. Ghosh	Ghosh 1952

Table 9: Mature Harappan sites in Rajasthan

S.No.	Site Name	District/River	Comments/Explorer	References
01	Baror 29° 10' N: 73° 20' E	Ganganagar-Hanumangarh/Ghaggar	L.P. Tessatori; A Stein	Tessatori 1917-18; Stein 1989: 35; Joshi *et al.* 1984:522
02	Site No. 34, 1 km E of Binjor	Ganganagar-Ghaggar	A Stein	Stein 1989: 36
03	Bhagwansar 1 29° 22' N: 73° 53' E	Ganganagar-Hanumangarh/Ghaggar		Joshi *et al.* 1984:522
04	Bhagwansar 2 29° 23' N: 73° 53' E	Ganganagar-Hanumangarh/Ghaggar		Joshi *et al.* 1984:522
05	Binjor 1 29° 14' N: 73° 07' E	Ganganagar/Ghaggar	A. Stein	Stein 1989: 35; Joshi *et al.* 1984: 522
06	Binjor 3 29° 00' N: 73° 12' E	Ganganagar/Ghaggar		Joshi *et al.* 1984:522
07	Bugian (GB 38) 29° 22' N: 73° 38' E	Ganganagar-Hanumangarh/Ghaggar	And PH	Joshi *et al.* 1984:522
08	Chak 11 29° 19' N: 73° 36' E	Ganganagar -Hanumangarh/Ghaggar		Joshi *et al.* 1984:522
09	Chak 15/3 29° 19' N: 73° 36' E	Ganganagar -Hanumangarh/Ghaggar		Joshi *et al.* 1984:522
10	Chak 21 29° 16' N: 73° 33' E	Ganganagar-Hanumangarh/Ghaggar		Joshi *et al.* 1984:522
11	Chak 43/Kharuwala Ther 29° 10' N: 73° 29' E	Ganganagar-Hanumangarh/Ghaggar		Stein 1989: 36; Joshi *et al.* 1984:522
12	Chak 50 29° 10' N: 73° 29' E	Ganganagar-Hanumangarh/Ghaggar		Joshi *et al.* 1984:522
13	Chak 71 29° 14' N: 73° 17' E	Ganganagar-Hanumangarh/Ghaggar		Joshi *et al.* 1984:522
14	Chak 72/3 29° 11' N: 73° 19' E	Ganganagar-Hanumangarh/Ghaggar		Joshi *et al.* 1984:522

S.No.	Site Name	District/River	Comments/Explorer	References
15	Chak 75 29° 11' N: 73° 18' E	Ganganagar-Hanumangarh/Ghaggar		Joshi *et al.* 1984:522
16	Chak 80 29° 12' N: 73° 15' E	Ganganagar-Hanumangarh/Ghaggar		Joshi *et al.* 1984:522
17	Jogiason Chak 1 29° 10' N: 74° 45' E	Ganganagar-Hanumangarh/Ghaggar	And PH	Joshi *et al.* 1984:522
18	Kalibangan 29° 29' N: 74° 08' E	Hanumangarh/Ghaggar	And PH, L.P. Tessatori; A, Stein, A. Ghosh 1952; Exc. B.B. Lal & B.K. Thapar	Tessatori 1917-18; Stein 1942, 1989: 25-26; Ghosh 1952; IAR 1960-61:31-32; 1961-62:39-44; 1962-63:20-31; 1963-64:30-39; 1964-65:35-39; 1965-66:38-41; 1966-67:31-33; 1967-68:42-45; 1968-69:28-32; Lal *et al.* 2003
19	Karoti 29° 10' N: 74° 52' E	Ganganagar-Hanumangarh/Ghaggar	And PH; L.P. Tessatori; A, Stein	Joshi *et al.* 1984:522
20	Mallawala-Tibba	Ganganagar -Hanumangarh/Ghaggar	L.P. Tessatori; A, Stein	Stein 1989: 35; Joshi *et al.* 1984: 522
21	Mathula Ther 29° 14' N: 74° 34' E	Ganganagar-Hanumangarh/Ghaggar	L.P. Tessatori; A, Stein	Stein 1989: 36; Joshi *et al.* 1984:522
22	Motasar Tibba 1 29° 09' N: 73° 28' E	Ganganagar-Hanumangarh/Ghaggar		Joshi *et al.* 1984:522
23	Motasar Tibba 2 29° 09' N: 73° 27' E	Ganganagar-Hanumangarh/Ghaggar		Joshi *et al.* 1984:522
24	Nohar 29° 10' N: 74° 45' E	Ganganagar-Hanumangarh/Ghaggar	And PH, A. Ghosh	Joshi *et al.* 1984:522; Ghosh 1952
25	RD-92/89 29° 10' N: 73° 04' E	Ganganagar/Ghaggar	And PH	Joshi *et al.* 1984:522
26	Sardargarh-2 29° 23' N: 73° 45' E	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Joshi *et al.* 1984:522; Ghosh 1952
27	Sherpura 29° 10' N: 75° 15' E	Ganganagar-Hanumangarh/Ghaggar	And PH, A. Ghosh	Joshi *et al.* 1984:522
28	Sothi 29° 11' N: 74° 50' E	Ganganagar-Hanumangarh/Ghaggar	And PH, A. Ghosh	Ghosh 1952; Joshi *et al.* 1984: 522; Ghosh 1952
29	Tarkhana Wala Dera 29° 14' N: 73° 14' E	Hanumangarh/Ghaggar	Exc. A Ghosh	Ghosh 1952; Joshi *et al.* 1984:522

Table 10: Ochre Coloured Pottery (OCP) sites in Rajasthan

S. No.	Site Name	District/River	Comments/Explorer	References
01	Au	Bharatpur	And PGW, BRW; Dir Arch Mus Raj	IAR 1965-66: 38
02	Noh	Bharatpur	And BRW, PGW, and EH exc. R.C. Agrawala *et al.*	IAR 1963-64:28-29; 64-65: 34-35; 65-66: 38; 1966-67: 30-31; 1968-69: 26; 1970-71: 31-32; 1971-72: 41-42
03	Pengore	Bharatpur	And PGW, BRW, Dir Arch Mus Raj	IAR 1965-66: 38
04	Sewar	Bharatpur	And PGW, BRW, Dir Arch Mus Raj	IAR 1965-66: 38
05	Kair	Bharatpur/Gambhiri	R.C. Agrawala *et al.*	IAR 1979-80: 62
06	Khan Khari (near Bayana)	Bharatpur/Gambhiri	R.C. Agrawala *et al.*	IAR 1979-80: 62
07	Nithar	Bharatpur/Gambhiri	R.C. Agrawala *et al.*	IAR 1979-80: 62
08	Aamai (Old Amravati)	Jaipur	Vijay Kumar	IAR 1973-74: 23
09	Achrol	Jaipur/Gomati	and micros, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 1979-80:62
10	Badhana	Jaipur	Vijay Kumar	IAR 1972-73: 28-29
11	Baliji	Jaipur	Vijay Kumar	IAR 1973-74: 23
12	Beedh ki Jori	Jaipur	And Kushana and terracotta, Vijay Kumar	IAR 1972-73: 28-29
13	Bhabru (Sonpura)	Jaipur	Vijay Kumar	IAR 1973-74: 23
14	Bhainsawal	Jaipur	and PGW, Vijay Kumar	IAR 1972-73: 28-29
15	Bhaishlana	Jaipur	Vijay Kumar	IAR 1973-74: 23
16	Bhomya ka Tiba	Jaipur	Vijay Kumar	IAR 1973-74: 23
17	Buchobharat	Jaipur	And BRW, Red Ware, Vijay Kumar	IAR 1973-74: 24
18	Daduka	Jaipur	And PGW, Red Ware, Vijay Kumar	IAR 1973-74: 24
19	Dhar	Jaipur	Vijay Kumar	IAR 1973-74: 23
20	Khedwala	Jaipur	Vijay Kumar	IAR 1972-73: 28-29
21	Kilayanpura 'B'	Jaipur	Vijay Kumar	IAR 1973-74: 23
22	Kiratpura	Jaipur	Vijay Kumar	IAR 1973-74: 23
23	Lalbaba	Jaipur	Vijay Kumar	IAR 1973-74: 23
24	Malion ka Tiba	Jaipur	Vijay Kumar	IAR 1973-74: 23
25	Mandha	Jaipur	And PGW, RW, Terracotta, Vijay Kumar	IAR 1972-73: 28-29
26	Manju Kota	Jaipur	Vijay Kumar	IAR 1973-74: 23
27	Purani Rewari	Jaipur	Vijay Kumar	IAR 1972-73: 28-29
28	Rajnota	Jaipur	And PGW, BRW, GW and Vijay Kumar	IAR 1972-73: 28-29
29	Ramjalra	Jaipur	and PGW, Vijay Kumar	IAR 1972-73: 28-29
30	Rana ki Radi	Jaipur	Vijay Kumar	IAR 1973-74: 23
31	Taskola	Jaipur	Vijay Kumar	IAR 1973-74: 23
32	Theekariya	Jaipur	and micros, Vijay Kumar	IAR 1973-74: 24
33	Aniyali	Jaipur/ Kasaunti	R.C. Agrawala *et al.*	IAR 1979-80: 62
34	Banar	Jaipur/ Kasaunti	and copper ore and working, R.C. Agrawala *et al*	IAR 1979-80: 62
35	Bhanti ri Tibri	Jaipur/ Kasaunti	R.C. Agrawala *et al*	IAR 1979-80: 62
36	Khokhro Khera	Jaipur/ Kasaunti	R.C. Agrawala *et al.*	IAR 1979-80: 63
37	Oda ki Dhani	Jaipur/ Kasaunti	and copper slag, R.C. Agrawala *et al*	IAR 1979-80: 63

S. No.	Site Name	District/River	Comments/Explorer	References
38	Boochara (Kolyara)	Jaipur/ Pando li	R.C. Agrawala *et al.*	IAR 1979-80: 62
39	Monyali Baori	Jaipur/ Pandoli	R.C. Agrawala *et al.*	IAR 1979-80: 63
40	Bhankri	Jaipur/ Sabi	Arch Mus Raj	IAR 1975-76: 77
41	Bondhansingh- ka -Tila	Jaipur/ Sabi	Arch Mus Raj	IAR 1975-76: 77
42	Jodhpura	Jaipur/ Sabi	Exc. R.C. Agrawala and Vijay Kumar Pd. I-; Pd. II-BRW, Pd. III-PGW, Pd. IV- NBP, Pd. V. Sunga Kushana Pottery	IAR 1972-73: 28-29
43	Chinchroli	Jhunjhunu	and copper slag, Arch Mus Raj	IAR 1980-81: 56
44	Galunda –i- dur	Jhunjhunu	Arch Mus Raj	IAR 1980-81: 56
45	Jodhpur	Jhunjhunu/Kantli	and micros, R.C. Agrawala	IAR 1979-80: 63
46	Jodhpura- Sonari	Jhunjhunu	And BRW, PGW, Micros, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20
47	Kojar	Jhunjhunu	Arch Mus Raj	IAR 1980-81: 56
48	Rampura	Jhunjhunu	And BRW, PGW, Micros and Historic, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20
49	Serfraguvar	Jhunjhunu	Arch Mus Raj	IAR 1980-81: 56
50	Kota Maholi	Sawai Madhopur/Panchana	R.C. Agrawala *et al.*	IAR 1979-80. 63
51	Ageri	Sikar/Kantli	R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20
52	Ajmeri	Sikar	And micros, Vijay Kumar	IAR 1981-82: 62
53	Bachari	Sikar	and micros, Vijay Kumar	IAR 1981-82· 62
54	Barah ki Dhani	Sikar	and micros, Vijay Kumar	IAR 1981-82: 62
55	Bayka	Sikar/Kantli	R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80
56	Bhita ki Gaondi	Sikar/ Kantli	and micros R.C Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 63
57	Bhojpura	Sikar/ Kantli	R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 63
58	Bhuralya	Sikar / Kantli	R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 63
59	Buchahar	Sikar	And copper bead and micros, Vijay Kumar	IAR 1981-82: 62
60	Byorka	Sikar /Kantli	and micros, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 63
61	Chiplata	Sikar /Kantli	R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 63
62	Ganeshwar	Sikar/Kantli	and copper objects, K.N. Dishit, Exc. R.C. Agrawala *et al.*	IAR 1977-78: 49; IAR 1977-78: 49; 79-80:65; 1981-82: 61-62; 83-84: 71-72; 87-88:101-102; 88-89:72-78
63	Gaonri	Sikar/Kantli	and copper slags, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 63
64	Gaonri Bandh	Sikar /Kantli	and copper slags, R.C. Agrawala *et al.*	IAR 1978-79: 20; 79-80: 63
65	Ghata	Sikar /Kantli	R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 63
66	Jambalpur	Sikar	And copper slag and micros, Vijay Kumar	IAR 1981-82: 62
67	Jhulna Tila	Sikar/Kantli	and Micros R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 64
68	Khoh Mundri	Sikar	and micros, Vijay Kumar	IAR 1981-82. 62
69	Kulhade ka Johad	Sikar/Kantli	R C Agrawala and Vijay Kumar	IAR 1978-79· 20; 79-80. 64
70	Kulra	Sikar	and copper slags, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20

S. No.	Site Name	District/River	Comments/Explorer	References
71	Kumhareri	Sikar/Kantli	and Micros R C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 64
72	Kuradhan ki Doongri	Sikar/ Kantli	and copper arrowhead, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80:64
73	Malyali	Sikar/ Kantli	and micros, Vijay Kumar	IAR 1981-82: 62
74	Meeno ki Dhani	Sikar/Kantli	and Micros R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80:64
75	Nimodh	Sikar/ Kantli	and copper slags, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 64
76	Para Bhitar ki Dhani	Sikar/ Kantli	and copper slags, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80. 64
77	Partheri	Sikar/Kantli	and micros R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 64
78	Pitahl Puri	Sikar	Vijay Kumar	IAR 1981-82: 62
79	Pyojara	Sikar/Kantli	R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 64
80	Raipur Jagir	Sikar	Vijay Kumar	IAR 1981-82: 62
81	Tapkeshwara Chavand ea	Sikar/Kantli	R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 64
82	Tejawala	Sikar/Kantli	R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80:65
83	Thoi	Sikar/Kantli	and Micros R C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 65
84	Umrawala	Sikar/Kantli	And copper slag and micros, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20; 79-80: 65
85	Jatala	Sikar/Dohan	R.C. Agrawala *et al.*	IAR 1979-80: 64
86	Bihani Pura	Sikar/Dohan	R.C. Agrawala *et al.*	IAR 1979-80: 63
87	Bihar	Sikar/Dohan	and copper implements, slag and working platform, R.C. Agrawala *et al.*	IAR 1979-80: 63
88	Burka Khera	Sikar/Dohan	and copper, R C. Agrawala *et al.*	IAR 1979-80: 63
89	Dabla ki Bani	Sikar/Dohan	R.C. Agrawala *et al.*	IAR 1979-80: 63
90	Tigri	Sikar/Dohan	and copper slag, R.C. Agrawala *et al.*	IAR 1979-80: 65
91	Aheerawala	Sikar/Kantli	and copper slag, R.C. Agrawala *et al.*	IAR 1979-80: 63
92	Balwara (Jorika Beed)	Sikar/Kantli	and copper, R.C. Agrawala *et al.*	IAR 1979-80: 63
93	Bani ka Chora	Sikar/Kantli	R.C. Agrawala *et al.*	IAR 1979-80: 63
94	Basedi	Sikar/Kantli	and copper slag, R.C. Agrawala *et al.*	IAR 1979-80: 63
95	Bhadwadi	Sikar/Kantli	R.C. Agrawala *et al.*	IAR 1979-80: 63
96	Chanuhan ki Dhani	Sikar/Kantli	R.C. Agrawala *et al.*	IAR 1979-80: 63
97	Dehra	Sikar/Kantli	R.C. Agrawala *et al.*	IAR 1979-80: 63
98	Dhoonwala	Sikar/Kantli	and copper slag, R.C. Agrawala *et al.*	IAR 1979-80: 63
99	Dolyada	Sikar/Kantli	R.C. Agrawala *et al.*	IAR 1979-80: 63
100	Golyari	Sikar/Kantli	and copper slag, R.C. Agrawala *et al.*	IAR 1979-80: 63
101	Jugalpura	Sikar/Kantli	and sturdy pottery, R.C. Agrawala *et al.*	IAR 1979-80: 64
102	Kanwat	Sikar/Kantli	R.C. Agrawala *et al.*	IAR 1979-80: 64
103	Madrajal Nala (Baleshwar)	Sikar/Kantli	R.C Agrawala *et al.*	IAR 1979-80: 64
104	Melda	Sikar/Kantli	and copper, R.C. Agrawala *et al.*	IAR 1979-80: 64
105	Nahro ke Kothi	Sikar/Kantli	R.C. Agrawala *et al.*	IAR 1979-80: 64
106	Panjadi	Sikar/Kantli	And micros and copper, R C. Agrawala *et al.*	IAR 1979-80: 64

S. No.	Site Name	District/River	Comments/Explorer	References
107	Poonchlari Dhani	Sikar/Kantli	and copper, R C. Agrawala *et al.*	IAR 1979-80: 64
108	Pyojara	Sikar/Kantli	and copper slag, R.C. Agrawala *et al.*	IAR 1979-80: 64
109	Tumat	Sikar/Kantli	and micros, R.C. Agrawala *et al.*	IAR 1979-80: 65
110	Unchibeni	Sikar/Kantli	R.C. Agrawala *et al.*	IAR 1979-80: 65
111	Bhoodoli	Sikar/Kantli (Chand rabhaga)	and copper objects, R.C. Agrawala *et al.*	IAR 1979-80: 63
112	Baleshwar	Sikar/Kantli	(?), Rangmahal, K. N. Dikshit *et al.*	IAR 1977-78: 49
113	Bakhtawar ki Dhani	Sikar/Kasaunti	R.C. Agrawala *et al.*	IAR 1979-80: 63
114	Banethi	Sikar/Kasaunti	R.C. Agrawala *et al.*	IAR 1979-80: 63
115	Chamrauli	Sikar/Kasaunti	and copper slag, R.C. Agrawala *et al.*	IAR 1979-80: 63
116	Delsar	Sikar/Kasaunti	And copper slag, and micros, R.C. Agrawala *et al.*	IAR 1979-80: 63
117	Dilpura	Sikar/Kasaunti	and copper slag, R.C. Agrawala *et al.*	IAR 1979-80: 63
118	Hinduka	Sikar/Kasaunti	and micros, R.C. Agrawala *et al.*	IAR 1979-80: 63
119	Khurdiya	Sikar/Kasaunti	and micros, R.C. Agrawala *et al.*	IAR 1979-80: 64
120	Kishore Pura	Sikar/Kasaunti	and copper slag, R.C. Agrawala *et al.*	IAR 1979-80: 64
121	Lomor	Sikar/Kasaunti	R.C. Agrawala *et al.*	IAR 1979-80: 64
122	Mothuka	Sikar/ Kasaunti	R.C. Agrawala *et al.*	IAR 1979-80: 64
123	Mungtor	Sikar/ Kasaunti	and copper smelting, R.C. Agrawala *et al.*	IAR 1979-80: 64
124	Purana Mothuka	Sikar/ Kasaunti	and copper slag, R.C. Agrawala *et al.*	IAR 1979-80: 64
125	Dhunga ka Nangla	Sikar/ Sabi	Vijay Kumar	IAR 1973-74: 24
126	Tigri	Sikar/ Sabi	Vijay Kumar	IAR 1973-74: 24
127	Khalra	Sikar/ Sota	and copper slag, R.C. Agrawala *et al.*	IAR 1979-80: 64
128	Loharwas Sota	Sikar/ Sota	And copper slag, and working platform, R.C. Agrawala *et al.*	IAR 1979-80: 64
129	Tigri	Sikar/ Dohan	R.C. Agrawala *et al.*	IAR 1979-80: 65
130	Tariyal	Sikar/ Kantli	Copper slag; R.C. Agrawala *et al.*	IAR 1979-80: 64
131	Sooral	Sikar/ Kantli	Copper working site; R.C. Agrawala *et al.*	IAR 1979-80: 64

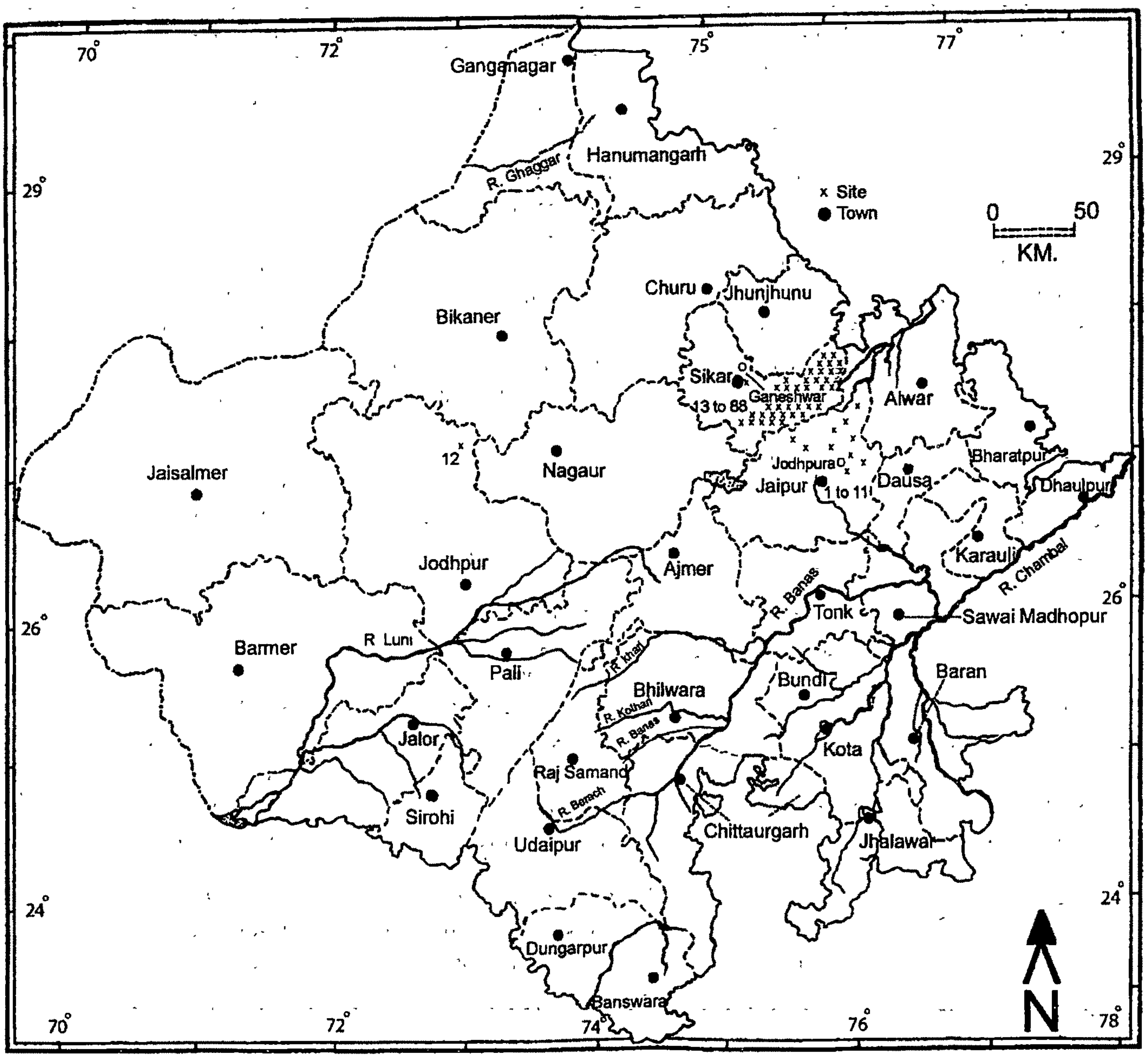

Fig. 5: Ganeshwar-Jodhpur culture sites in Rajasthan

Table 11: Ganeshwar-Jodhpura culture sites in Rajasthan

S.No.	Site Name	District/River	Comments/Explorer	References
1.	Barodiya	Jaipur	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
2.	Barwars	Jaipur	Also Meso, P.L. Chakravarty and Vijai Kumar Arch Mus, Raj	IAR 1987-88: 100
3.	Chak- Dhelwavan	Jaipur	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
4.	Chimanpura	Jaipur	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
5.	Chithwari/ Cheethwari	Jaipur	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100; 1988-89:76
6.	Devan	Jaipur	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100

S.No.	Site Name	District/River	Comments/Explorer	References
7.	Dvipura	Jaipur	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
8.	Ganeshpura	Jaipur	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
9.	Medh	Jaipur	P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
10.	Pragpura	Jaipur	P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
11.	Narera	Jaipur	Copper Age; Arch Mus Raj	IAR 1983-84: 71
12.	Gogamenhi	Jaisalmer	Ganeshwar-Jodhpura pottery, P.L. Chakravarty and Vijay Kumar Arch Mus, Raj	IAR 1990-91: 60
13.	Ajit Garh	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
14.	Baleshwar 27° 44 N: 75° 51 E	Sikar		Joshi *et al.* 1984: 520
15.	Baneti 27° 48' N: 76° 07' E	Sikar		Joshi *et al.* 1984: 520
16.	Banher 27° 50'N: 76° 07' E	Sikar		Joshi *et al.* 1984: 520
17.	Barnagar 27° 33' N: 76° 07' E	Sikar		Joshi *et al.* 1984: 520
18.	Basri 27° 38' N: 75° 45' E	Sikar		Joshi *et al.* 1984: 520
19.	Beed ki Jodhi 27° 36' N: 76° 09' E	Sikar		Joshi *et al.* 1984: 520
20.	Bhabhra 27° 28' N: 76° 01' E	Sikar		Joshi *et al.* 1984: 520
21.	Bhadwari 27° 34' N: 75 40 E	Sikar		Joshi *et al.* 1984: 520
22.	Bhageshwar	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
23.	Bhagodha	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
24.	Bhagoga	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
25.	Bhaikhri 27° 34' N: 76° 07'	Sikar		Joshi *et al.* 1984: 520
26.	Bhainsalana 27° 39' N: 76° 05' E	Sikar		Joshi *et al.* 1984: 520
27.	Bhakhtawar ki Dhani 27° 51' N: 76° 06' E	Sikar		Joshi *et al.* 1984: 520
28.	Bhojpura 27° 33' N: 75° 35' E	Sikar		Joshi *et al.* 1984: 520
29.	Bhopya	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
30.	Bhudoli (probably same as Butholi)	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
31.	Bhukha Bhar 27° 37' N: 76° E	Sikar		Joshi *et al.* 1984: 520
32.	Bihar 27° 52' N: 75° 57' E	Sikar		Joshi *et al.* 1984: 520
33.	Biharipura 27° 54' N: 75° 54' E	Sikar		Joshi *et al.* 1984: 520
34.	Buchara 27° 33' N: 75° 58' E	Sikar		Joshi *et al.* 1984: 520
35.	Butholi 27° 41'N: 75° 46' E	Sikar		Joshi *et al.* 1984: 520

S.No.	Site Name	District/River	Comments/Explorer	References
36.	Burha 27° 54' N: 75° 58' E	Sikar		Joshi *et al.* 1984: 520
37.	Chala	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
38.	Chapar	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
39.	Chardera 27° 51' N: 76° 06' E	Sikar		Joshi *et al.* 1984: 520
40.	Chaudhari ka Nangal 27° 53' N: 76° 07' E	Sikar		Joshi *et al.* 1984: 520
41.	Chiplata 27° 34' N: 75° 34' E			
42.	Dariba 27° 41' N: 75° 54' E	Sikar		Joshi *et al.* 1984: 520
43.	Dilpura 27° 50' N: 76° 04' E	Sikar		Joshi *et al.* 1984: 520
44.	Doken	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
45.	Dungar Das ki Dhani	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
46.	Ganeshwar 27° 40' N: 75° 49' E	Sikar	R.C. Agrawala; Exc. Vijay Kumar	IAR 1981-82: 61-62; 83-84:71-72; 87-88:101-102; 88-89:72-78; 88-89:72-78
47.	Ghasipura	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
48.	Ghata 27° 35' N: 75° 51' E	Sikar		Joshi *et al.* 1984: 520
49.	Govindpura	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
50.	Hothoka (Mothoka) 27° 50' N: 75° 05' E	Sikar		Joshi *et al.* 1984: 520
51.	Hovra 27° 34' N: 75° 36's E	Sikar		Joshi *et al.* 1984: 520
52.	Imloha	Sikar	P.L Chakravarty and Vijai Kumar	IAR 1987-88: 100
53.	Jaitpura	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
54.	Jarinda	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
55.	Jheer ki Chowki	Sikar	P.L Chakravarty and Vijai Kumar	IAR 1987-88: 100
56.	Jhiloo	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
57.	Jodhpura 27° 55' N: 75° 59' E	Sikar		Joshi *et al.* 1984: 520
58.	Khard Beenjpur	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
59.	Khera 27° 55' N. 75° 59' E	Sikar		Joshi *et al.* 1984: 520
60.	Khobra Road	Sikar	P.L Chakravarty and Vijai Kumar	IAR 1987-88: 100
61.	Kokana	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
62.	Kolyara 27° 44' N: 75° 00' E	Sikar		Joshi *et al.* 1984: 520
63.	Mabri	Sikar	P.L Chakravarty and Vijai Kumar	IAR 1987-88: 100
64.	Mahava	Sikar	P.L Chakravarty and Vijai Kumar	IAR 1987-88: 100
65.	Malawali Dhani 27° 43' N: 75° 46' E	Sikar		Joshi *et al.* 1984: 520
66	Mandoli	Sikar	P.L Chakravarty and Vijai Kumar	IAR 1987-88: 100
67.	Mandu 27° 44' N: 75° 00' E	Sikar		Joshi *et al.* 1984: 520

S.No.	Site Name	District/River	Comments/Explorer	References
68.	Mokabas	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
69.	Natha ki Nagal	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 101
70.	Neemed	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
71.	Nimki 27°35' N5 75° 36' E	Sikar		Joshi *et al.* 1984: 520
72.	Panditpur 27°36' 76° 03' E	Sikar		Joshi *et al.* 1984: 520
73.	Paragpura 27°36'N.: 76° 03' E	Sikar		Joshi *et al.* 1984: 520
74.	Partheri 27°33' N: 75° 45' E	Sikar		Joshi *et al.* 1984: 521
75.	Purani Partheri 27° 37'N: 76° 09' E	Sikar		Joshi *et al.* 1984: 521
76.	Rajnotha 27° 36'N: 76° 10' E	Sikar		Joshi *et al.* 1984: 521
77.	Ram Jhalra 27° 35N: 76° 09'E	Sikar		Joshi *et al.* 1984: 521
78.	Ranasar 27° 44 N:75° 43'E	Sikar		Joshi *et al.* 1984: 521
79.	Saladipura	Sikar	P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 101
80.	Sarohi 27° 43' N: 75° 44' E	Sikar		Joshi *et al.* 1984: 521
81.	Sedh ki Dungri	Sikar	P L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
82.	Sedoda 27° 39'N: 75° 49'E	Sikar		Joshi *et al.* 1984: 521
83.	Somanya ki Baoli 27° 32' N: 75° 56' E	Sikar		Joshi *et al.* 1984: 521
84.	Thikna 27° 32' N: 76° 06' E	Sikar		Joshi *et al.* 1984: 521
85.	Thoi 27° 32' N: 76° 45' E	Sikar		Joshi *et al.* 1984: 521
86.	Todawali	Sikar	P. L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
87.	Tunda	Sikar	P. L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
88.	Khera (Balwar)	Sikar/Kantli	Vijay Kumar *et al.*	IAR 1979-80: 64

Table 12:Copper hoard sites in Rajasthan

S.No.	Site Name	District	References
01	Ekalasimgha	Ajmer	Agrawala and Vijay Kumar 1982
02	Dantia	Alwar	Dhaka 2005
03	Balambasai	Alwar	Dhaka 2005
04	Mallaha	Bharatpur	Dhaka 2005
05	Sabania	Bikaner	Handa 1968
06	Poogal	Bikaner	Dhaka 2005
07	Namana	Bundi	Dhaka 2005
08	Padaliya	Chittaurgarh	Agrawala 1979: 91
09	Nandlalpura	Jaipur	Agrawala 1979: 92
10	Chithwari	Jaipur	Singh 1993
11	Medh	Jaipur	Dhaka 2005
12	Jorpura	Jaipur	Dhaka 2005
13	Elana	Jalore	Agrawala 1979: 92
14	Kurada	Nagaur	Agrawala and Vijay Kumar 1982
15	Chhapari	Nagaur	Dhaka 2005
16	Bhandar	Pali	Dhaka 2005
17	Varman	Sirohi	Dhaka 2002
18	Sakatpura	Tonk	Dhaka 2005
19	Karera Bujarg	Tonk	Dhaka 2005
20	Mavli Dangiyan	Udaipur	Dhaka 2005

Table 13: Painted Grey Ware (PGW) sites in Rajasthan

S.No.	Site Name	District/River	Comments/Explorer	References
01	Chosla	Ajmer/Banas	And BRW, NBP, Micros, ASI	IAR 1958-59: 45
02	Purana Garh	Alwar	And GW, E Hist, Med Pott R.P. Sharma and M.G. Sharma	IAR 1976-77: 79
03	Bijwa	Alwar	B.B. Lal	IAR 1954-55: 61
04	Abar	Bharatpur	and E Hist, Vijay Kumar	IAR 1971-72: 41
05	Agama	Bharatpur	B.S. Negi ASI	IAR 1980-81: 55
06	Aghapur	Bharatpur	and Kushana and Shunga sculptures, Arch Mus Raj	IAR 1961-62: 38; 1962-63: 18; 1963-64: 28
07	Au	Bharatpur	And OCP, BRW, Arch Mus Raj	IAR 1963-64: 28; 1965-66: 38
08	Babain	Bharatpur	B.S. Negi ASI	IAR 1977-78: 46
09	Bagdhari	Bharatpur	B.S. Negi ASI	IAR 1977-78: 46; 1978-79: 19
10	Bahaj	Bharatpur	B.S. Negi ASI	IAR 1980-81: 55
11	Beru	Bharatpur	And BRW, BSP, B.S. Negi ASI	IAR 1984-85: 71
12	Bhandor	Bharatpur	B.S. Negi ASI	IAR 1977-78: 46; 1978-79: 19
13	Bhimnagar	Bharatpur	Arch Mus Raj	IAR 1970-71: 31
14	Birawi	Bharatpur	B.S. Negi ASI	IAR 1977-78: 46
15	Borai	Bharatpur	B.S. Negi ASI	IAR 1978-79: 19

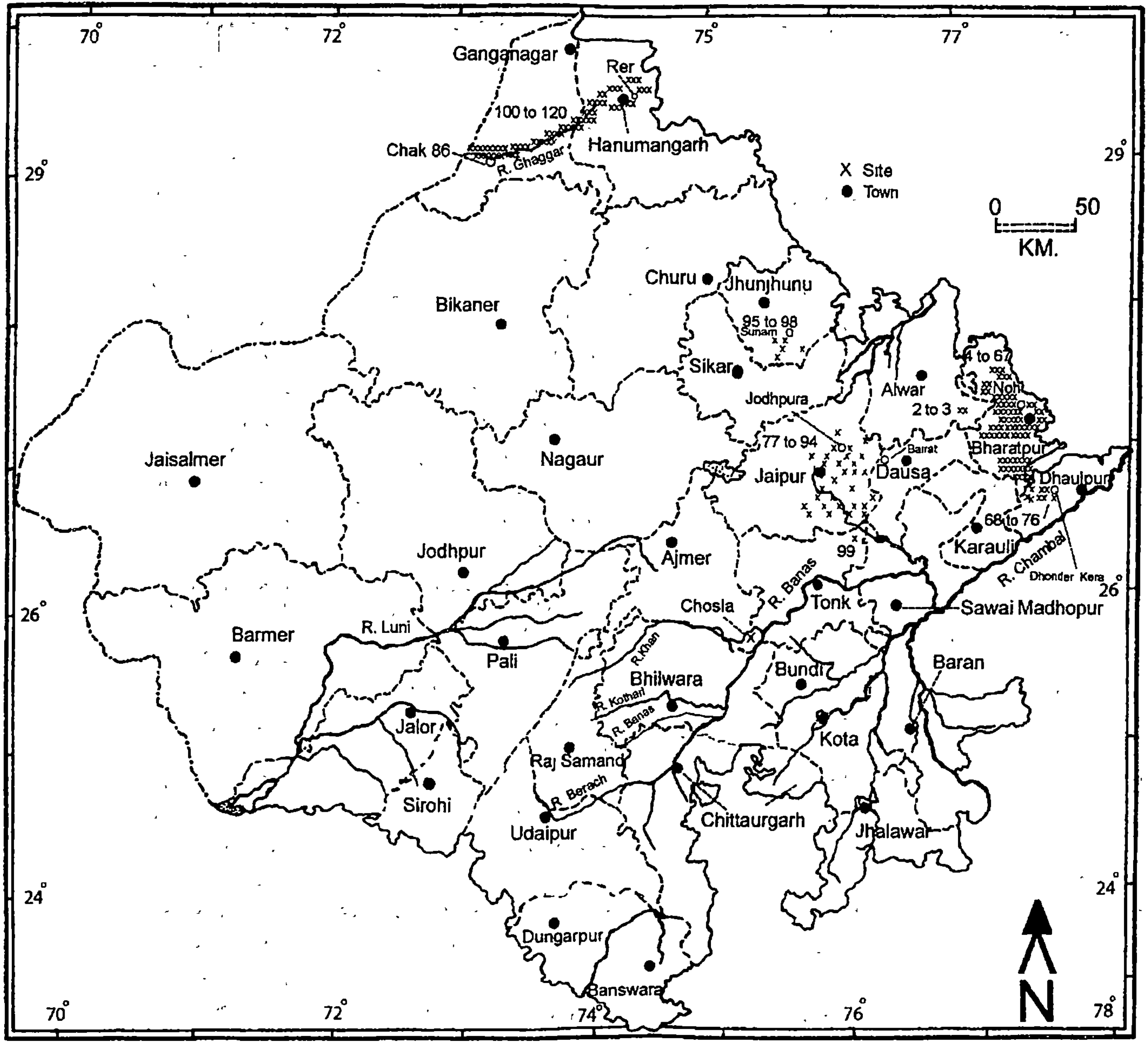

Fig. 6: Painted Grey Ware sites in Rajasthan

S.No.	Site Name	District/River	Comments/Explorer	References
16	Darapur	Bharatpur	And BRW, Kushana TC figurines and sculptures, Arch Mus Raj	IAR 1970-71: 31
17	Dehra	Bharatpur	And BRW, NBP, Vijay Kumar, Arch Mus Raj	IAR 1966-67: 30; 1971-72: 41
18	Gahanawali	Bharatpur	B.S. Negi ASI	IAR 1980-81: 55
19	Gamri	Bharatpur	Vijay Kumar, Arch Mus Raj	IAR 1971-72: 41
20	Gangawak	Bharatpur	And BRW, and BSP, B.S. Negi	IAR 1984-85. 71
21	Gulena	Bharatpur	And BRW, and BSP, B.S Negi	IAR 1980-81. 55
22	Ikran	Bharatpur	Arch Mus Raj	IAR 1970-71: 31

S.No.	Site Name	District/River	Comments/Explorer	References
23	Januthar	Bharatpur	And E Hist, Arch Mus Raj, B.S. Negi	IAR 1965-66: 38; 1980-81:55
24	Jatoli Thun	Bharatpur	B.S. Negi ASI	IAR 1980-81: 55
25	Jheelra	Bharatpur	B.S. Negi ASI	IAR 1978-79: 19
26	Kama	Bharatpur	Arch Mus Raj, B.S. Negi	IAR 1963-64: 28; 1980-81: 55
27	Kaman	Bharatpur	and. sculptures and 9th cent. Inscription, D.P. Agrawal	IAR 1957-58: 68-69
28	Karua	Bharatpur	B.S. Negi ASI	IAR 1978-79: 19
29	Kasot	Bharatpur	B.S. Negi ASI	IAR 1978-79: 19
30	Kerawa	Bharatpur	Arch Mus Raj	IAR 1970-71: 31
31	Kesot	Bharatpur	Arch Mus Raj	IAR 1970-71: 31
32	Korer	Bharatpur	and GW, Arch Mus Raj	IAR 1970-71: 31
33	Kushana	Bharatpur	E Hist, Arch Mus Raj	IAR 1965-66: 38
34	Kwardiya	Bharatpur	and BRW, Arch Mus Raj	IAR 1970-71: 31
35	Nagle Methna	Bharatpur	B.S. Negi ASI	IAR 1978-79: 19
36	Nandera	Bharatpur	And GW, BSP, B.S. Negi	IAR 1981-82: 55
37	Naunera	Bharatpur	RW and Med Pott B.S. Negi ASI	
38	Noh	Bharatpur	And OCP, BRW, and E Hist excavated by R.C. Agrawala *et al.* Arch Mus Raj	IAR 1962-63:18; 1963-64: 28-29; 1964-65: 34-35; 1965-66: 38; 1966-67: 30-31; 1968-69: 26; 1970-71: 31-32; 1971-72: 41- 42
39	Pahari	Bharatpur	And RW, Med Pott B.S. Negi ASI	IAR 1984-85: 71
40	Pai	Bharatpur	And GW, RW, and BSP, B.S. Negi ASI	IAR 1981-82: 55
41	Pala	Bharatpur	ASI	IAR 1978-79: 19; 1979-80: 68
42	Paremdara	Bharatpur	Arch Mus Raj	IAR 1970-71: 31
43	Pengore	Bharatpur	OCP, BRW, Arch Mus Raj	IAR 1965-66: 38
44	Ranota	Bharatpur	GW, and RW, B.S. Negi ASI	IAR 1984-85: 72
45	Sahera	Bharatpur	And GW, RW, BSP, B S. Negi ASI	IAR 1981-82: 55
46	Sahesan	Bharatpur	And RW, Med Pott B.S. Negi ASI	IAR 1984-85: 71
47	Santruka	Bharatpur	B.S. Negi ASI	IAR 1978-79: 19
48	Satar	Bharatpur	And BRW, and Muslim ware, Arch Mus Raj	IAR 1970-71: 31
49	Sewar	Bharatpur	And OCP, BRW, Arch Mus Raj; B.S Negi, ASI	IAR 1965-66: 38; 1977-78: 46
50	Sikhasa	Bharatpur	ASI	IAR 1979-80. 68
51	Sinpini	Bharatpur	B.S. Negi ASI	IAR 1977-78: 46; 1978-79: 19
52	Songaon	Bharatpur	B.S. Negi ASI	IAR 1980-81: 55
53	Tamarer	Bharatpur	ASI	IAR 1979-80: 68
54	Tatmar	Bharatpur	B.S. Negi ASI	IAR 1977-78: 46; 1978-79: 19
55	Therya	Bharatpur	Vijay Kumar, Arch Mus Raj	IAR 1971-72: 41
56	Tomrer	Bharatpur	Arch Mus Raj	IAR 1970-71: 31
57	Umra	Bharatpur	and BRW, Arch Mus Raj	IAR 1970-71: 31
58	Umra Au	Bharatpur	B.S. Negi ASI	IAR 1980-81: 55
59	Undra	Bharatpur	Vijay Kumar, Arch Mus Raj	IAR 1971-72: 41
60	Vajhara	Bharatpur	B S. Negi ASI	IAR 1980-81: 55
61	Viravi	Bharatpur	and E Hist, Vijay Kumar, Arch Mus Raj	IAR 1971-72: 41

S.No.	Site Name	District/River	Comments/Explorer	References
62	Karon	Bharatpur/Banganga	B.S. Negi ASI	IAR 1979-80: 105
63	Khoh	Bharatpur/Banganga	B.S. Negi ASI	IAR 1979-80: 105
64	Paramodara	Bharatpur/Banganga	B.S. Negi ASI	IAR 1979-80: 105
65	Rahmagarh	Bharatpur/Banganga	BRW, Early Historic pottery, L.C. Singh, R.P. Sharma, B. Singh, and B.S. Negi ASI	IAR 1978-79: 19
66	Sarsena	Bharatpur/Banganga	BRW, Early Historic pottery, L.C. Singh, R.P. Sharma, B. Singh, and B.S. Negi ASI	IAR 1978-79. 19
67	Unaya	Bharatpur/Banganga	B.S. Negi ASI	IAR 1979-80: 105
68	Bari 26° 39' N ; 77° 37' E	Dhaulpur	Early medieval, C.L. Suri, I.D. Diwedi, G.S. Gaur, L.S. Mamani, V.P. Verma, V. Kumar ASI	IAR 1991-92: 93
69	Dhonder Khera 26° 42' N.; 77° 45' 43" E	Dhaulpur/Mendki	And BRW, BSP, Saivite sculptures, Arch Mus Raj; early medieval and historical, C.L. Suri *et al.*; Exc Ram Saran ASI	IAR IAR 1964-65: 35; 1991-92:94; 1993-94: 91-93
70	Garhi 26° 45' 52" N.; 78° 06' E	Dhaulpur	E Hist and medieval, R. Saran *et al.* ASI	IAR 1992-93: 87
71	Hansai 26° 47' 52" N.; 77° 40' E	Dhaulpur	And Micros, BRW, NBP, BSP, C.L. Suri *et al.* ASI	IAR 1991-92: 94
72	Karka Khilli 26° 46' 20" N ; 78° 02' 09" E	Dhaulpur	And micros, medieval B&R, C.L. Suri *et al.* ASI	IAR 1991-92: 96
73	Kolwa 26° 46' 18" N.; 77 49' 23" E	Dhaulpur	And BRW, medieval, C.L. Suri *et al.* ASI	IAR 1991-92: 94
74	Nagar 26° 33' 15" N.; 77° 47' 30" E	Dhaulpur	And BRW, C.L. Suri *et al.* ASI	IAR 1991-92: 96
75	Sepau 26° 49' N.; 77° 45' E	Dhaulpur	And BSP, medieval, C.L. Suri *et al.* ASI	IAR 1991-92: 96
76	Son (Sayapur Rakoli ka Khera) 26° 47' 44" N.; 77° 51' 30" E	Dhaulpur	And historical and early medieval, R. Saran *et al.* ASI	IAR 1992-93. 87
77	Bairat/Sabi	Jaipur	K.N. Dikshit; And Late NBP, and Medieval Pd Exc. N.R. Banerjee	IAR 1958-59: 74; 1962-63: 31
78	Bhainsawal	Jaipur	And OCP, Vijay Kumar	IAR 1972-73: 28-29
79	Budha	Jaipur	And RW, Vijay Kumar	IAR 1973-74: 24
80	Chak- Muzzafarpur	Jaipur	P.L. Charavarty and Vijay Kumar Arch Mus Raj	IAR 1987-88 100
81	Chak-Sanga-ka-Was	Jaipur	P.L. Charavarty and Vijay Kumar Arch Mus Raj	IAR 1987-88: 100
82	Chak-Sheo Singhpura	Jaipur	P.L. Charavarty and Vijay Kumar Arch Mus Raj	IAR 1987-88: 100
83	Daduka	Jaipur	And OCP, RW, Vijay Kumar Arch Mus Raj	IAR 1973-74: 24
84	Gothnari	Jaipur	P.L. Charavarty and Vijay Kumar Arch Mus Raj	IAR 1987-88: 100
85	Hanuvatpura	Jaipur	P.L. Charavarty and Vijay Kumar Arch Mus Raj	IAR 1987-88: 100
86	Kiradot	Jaipur	and Kushana, Vijay Kumar Arch Mus Raj	IAR 1972-73: 28-29

S.No.	Site Name	District/River	Comments/Explorer	References
87	Mandha	Jaipur	And OCP, Kushana and TC, Vijay Kumar	IAR 1972-73: 28-29
88	Panditpura	Jaipur	And BRW, Vijay Kumar	IAR 1973-74: 24
89	Purani Partheri	Jaipur	and GW, Vijay Kumar Arch Mus Raj	IAR 1972-73: 28-29
90	Rajnota	Jaipur	And BRW, GW, and OCP, Vijay Kumar	IAR 1972-73: 28-29
91	Ramjalra	Jaipur	And OCP Vijay Kumar Arch Mus Raj	IAR 1972-73: 28-29
92	Gondi	Jaipur/Bandi	And NBP, BRW, Early Historic ASI	IAR 1958-59: 45
93	Bairat	Jaipur/Sabi	B.B. Lal, K.N. Dikshit	IAR 1954-55:61; 1958-59: 74
94	Jodhpura	Jaipur/Sabi	Exp. K.N. Dikshit, Exc. R.C. Agrawala *et al.* Pd. I- OCP, Pd. II- BRW, Pd. III- PGW, Pd. IV- NBP Pd. V- Shunga Kushana	IAR 1958-59 74; 1972-73: 28-29
95	Jodhpur Sonari	Jhunjhunu	And OCP, BRW, Micros and Historic, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20
96	Rampura	Jhunjhunu	And OCP, BRW, Micros and Historic, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20
97	Sonari ka Ghat	Jhunjhunu/Kantli	And Rang Mahal and BRW, K. N. Dikshit *et al.*	IAR 1977-78: 47
98	Sunari 27° 53' N.: 75° 56' E	Jhunjhunu/Kantli	Exc. R.C. Agrawal *et al.* Pd. I- PGW, Pd. II- NBP, and Pd. III- Shunga-Kushana	IAR 1980-81:56
99	Pachala	Tonk	Vijay Kumar	IAR 1971-72: 41
100	Beror	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980:25-26
101	Chak 15/4	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26
102	Chak 21	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980:25-26
103	Chak 361/A	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26
104	Chak 39/1	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26
105	Chak 40	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Ghosh 1952
106	Chak 58/1	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26
107	Chak 59	Ganganagar-Hanumangarh/Ghaggar	A.Ghosh	Dalal 1980: 25-26
108	Chak 71/1	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26
109	Chak 72/1	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26
100	Chak 72/2	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26
111	Chak 74	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26
112	Chak 86	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Ghosh 1952
113	Chak 86IA	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26

S.No.	Site Name	District/River	Comments/Explorer	References
114	Chak 86IB	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26
115	Chak 86 II	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26
116	Chak 87	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26
117	Kalibangan 4	Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26
118	Chak 11	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26
119	Chak 15/3	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25-26
120	Rer	Hanumangarh/Ghaggar	A. Ghosh	Ghosh 1952

Table 14: Megalithic sites in Rajasthan

S.No.	Site Name	District	Comments/Explorer	References
01	Khera	Bharatpur	Cairns, ACL Carlleyle	Carlleyle 1878
02	Satmas	Bharatpur	Cairns, ACL Carlleyle	Carlleyle 1878
03	Machari	Dausa	Cairns, ACL Carlleyle	Carlleyle 1878
04	Dausa	Dausa	Stone circles and cairns, ACL Carlleyle	Carlleyle 1878
05	Junagaon	Bhilwara	B.R. Meena *et al.*	IAR 1984-85: 67

Table 15: Early Historic sites in Rajasthan

S.No.	Site Name	District/River	Comments/Explorer	References
1.	Chosla	Ajmer/Banas	NBP, PGW, RW, Micros, ASI	IAR 1958-59: 45
2.	Saptarshighat	Ajmer	Gupta sculptures, M.N. Deshpande	IAR 1962-63: 19
3.	Nand	Ajmer	Kushana Relief, R.C. Agrawala	IAR 1958-59: 73
4.	Bhangdoli	Alwar	EH, coarse GW and Med pott A.K. Khanna	IAR 1984-85: 69
5.	Dhan Karewarza	Alwar	GW , EH, Med pott R.P. Sharma and M G. Sharma	IAR 1976-77: 79
6.	Dhudewala	Alwar	GW , EH, Med pott R.P. Sharma and M.G. Sharma	IAR 1976-77: 79
7.	Purana Garh	Alwar	PGW, GW , EH, Med pott R.P. Sharma and M.G. Sharma	IAR 1976-77: 79
8.	Selli Boari	Alwar	EH pottery, A.K. Khanna ASI	IAR 1984-85: 70
9.	Badla	Alwar	Kushana, A.K. Khanna ASI	IAR 1981-82: 55
10.	Bajora	Alwar	Kushana, A.K. Khanna ASI	IAR 1981-82: 55
11.	Goth	Alwar	Kushana, A.K. Khanna ASI	IAR 1981-82: 55
12.	Hoda Heli	Alwar	Kushana, A.K. Khanna ASI	IAR 1981-82: 55

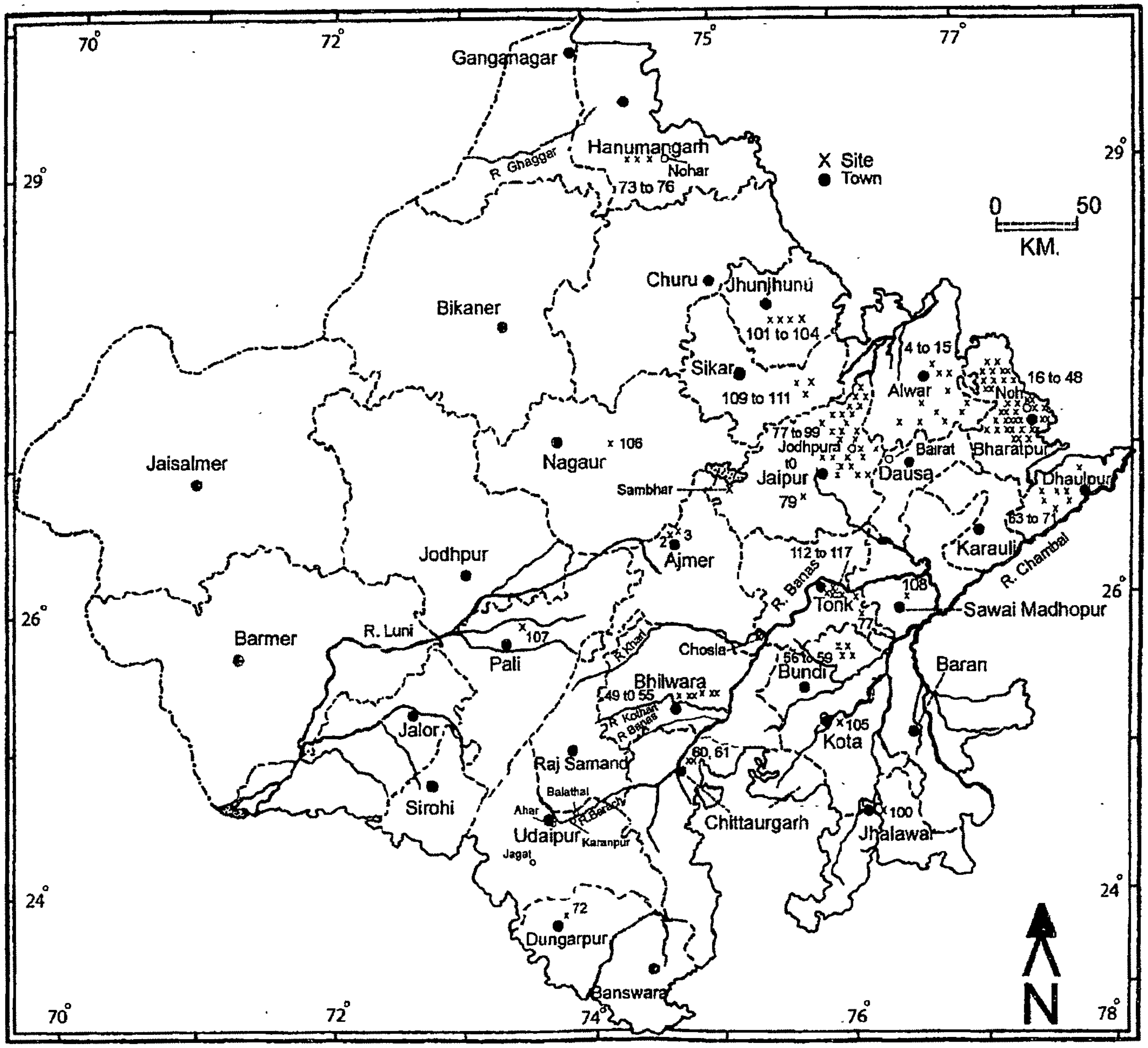

Fig. 7: Early Historic sites in Rajasthan

S.No.	Site Name	District/River	Comments/Explorer	References
13.	Khelpur	Alwar	Kushana, A.K. Khanna ASI	IAR 1981-82: 55
14.	Nandwari	Alwar	Kushana, A.K. Khanna ASI	IAR 1981-82· 55
15.	Parbeni	Alwar	Kushana, A.K. Khanna ASI	IAR 1981-82: 55
16.	Au	Bharatpur	NBP, OCP, BRW; Arch Mus Raj	IAR 1971-72: 41
17.	Abar	Bharatpur	RW (Kushana) and PGW, Vijay Kumar	IAR 1971-72: 41
18.	Bachamdi	Bharatpur	RW (Kushana) Vijay Kumar	IAR 1971-72: 41
19	Bahnera	Bharatpur	RW (Kushana), GW, Vijay Kumar	IAR 1971-72: 41
20	Barso	Bharatpur	RW (Kushana), Vijay Kumar	IAR 1971-72: 41

S.No.	Site Name	District/River	Comments/Explorer	References
21.	Belara Bada	Bharatpur	RW (Kushana), PGW, Vijay Kumar	IAR 1971-72. 41
22.	Naogaya	Bharatpur	RW Kushana a a bricks, Vijay Kumar	IAR 1971-72: 41
23.	Virabai	Bharatpur	RW, Kushana, PGW, Torso of Yaksha of c, 2nd-1st cent, .B.C., Dir, Arch Mus Raj	IAR 1966-67.68; 71-72: 41; 1971-72: 41
24.	Arwar	Bharatpur	Kushana a a and successive periods, ASI	IAR 1979-80 68
25.	Buharu	Bharatpur	Kushana a a and successive periods, ASI	IAR 1979-80 68
26.	Umrain	Bharatpur	Kushana a a and successive periods, ASI	IAR 1979-80 68
27.	Unaya	Bharatpur	Kushana a a and successive periods, ASI	IAR 1979-80 68
28.	Aghapur	Bharatpur	Kushana sculptures, ArchMusRaj	IAR 1962-63: 18
29	Darapur	Bharatpur	Kushana terracotta figurines and sculptures, Arch Mus Raj	IAR 1970-71: 31
30.	Vahaja	Bharatpur	RW ArchMusRaj	IAR 1970-71 31
31.	Babekher	Bharatpur	EH, D.N. Dimri ASI	IAR 1985-86: 69
32.	Dehra	Bharatpur	NBP, BRW, PGW., Vijai Kumar	IAR 1971-72: 41
33.	Januthar	Bharatpur	PGW, EH, Arch Mus, Raj	IAR 1965-66: 38
34.	Kushana	Bharatpur	PGW, EH, Arch Mus, Raj	IAR 1965-66. 38
35	Luhasa	Bharatpur	EH, D.N. Dimri ASI	IAR 1985-86: 69
36.	Maharaj Pura	Bharatpur	RW, B & R, D.N. Dimri ASI	IAR 1988-89: 75
37.	Modiya Lalita	Bharatpur	EH, D.N. Dimri ASI	IAR 1985-86: 69
38.	Nandera	Bharatpur	PGW, GW, RW and BSP, B.S. Negi ASI	IAR 1981-82: 55
39.	Naunera	Bharatpur	PGW, GW, RW and BSP, and Med. Pott. B.S. Negi ASI	IAR 1981-82: 55; 1984-85: 71
40.	Noh	Bharatpur	RW, B & R, NBP, PGW, OCP, exc. R.C. Agrawala *et al.*	IAR 1963-64: 28-29; 1966-67: 30-31; 1968-69. 26; 1970-71: 31-32; 1971-72: 41- 42
41.	Pai	Bharatpur	PGW, GW, RW and BSP, B.S. Negi ASI	IAR 1981-82: 55
42,	Pangare	Bharatpur	Late Gupta sculptures; Arch Mus Raj	IAR 1962-63: 28
43.	Raj Garh	Bharatpur	EH, D.N. Dimri ASI	IAR 1985-86: 70
44.	Ramagarh	Bharatpur/ Banganga	B & R, PGW, EH pottery, L.C. Singh *et al.*	IAR 1966-67: 68; 78-79: 19
45.	Sahera	Bharatpur	PGW, GW, RW and BSP, B.S. Negi ASI	IAR 1981-82: 55
46.	Satwas	Bharatpur	RW (Kushana a a a) Teracottas, Vijai Kumar	IAR 1971-72: 41
47.	Surota	Bharatpur	GW and terracotta, Vijai Kumar	IAR 1971-72: 41
48.	Sarsena	Bharatpur/Banganga	B & R, PGW, EH pottery, L.C. Singh *et al.*	IAR 1978-79. 19
49.	Aguncha	Bhilwara/Mansi	Pd.I. Pre-Mauryan and Mauryan, Pd. II. Sunga-Kushana; Pd III. Gupta B.L. Nagarch *et al.*	IAR 1980-81: 55
50.	Road cutting between Aguncha and Bhilwara	Bhilwara	Pd I. PGW, NBP, etc. Pre-Maurya and Maurya, Pd. II. Sunga-Kushana, Pd. III. Gupta; B.L. Nagarch *et al.*	IAR 1980-81: 55
51.	Barasani	Bhilwara	EH, RW, GW, B.R. Meena *et al.*	IAR 1984-85: 67
52.	Lachhura 26° 24' N: 77° 53' E	Bhilwara	EH, N.B.P, BSP, RW, GW, historical settlement, ring-wells, B.R. Meena *et al.*	IAR 1984-85: 68
53	Hurra	Bhilwara	RP, ASI	IAR 1958-59 45
54.	Mataji ki Mangri	Bhilwara	Gupta and Post-Gupta pottery and terracottas	IAR 1984-85. 68
55	Bayana	Bhilwara	Gupta sculptures, S.P. Srivastava	

S.No.	Site Name	District/River	Comments/Explorer	References
56.	Bajar	Bundi	EH, B.M.S Parmar	IAR 1973-74: 23
57.	Bhanjori	Bundi	EH, B.M.S Parmar	IAR 1973-74: 23
58.	Daglavda	Bundi	EH, B.M.S Parmar	IAR 1973-74: 23
59.	Deyi	Bundi	EH, B.M.S Parmar	IAR 1973-74: 23
60.	Gujaron ka Khera	Chittaurgarh	EH, N. Vyas *et al.*	IAR 1981-82: 99
61.	Nagari	Chittaurgarh	EH, ACL Carlleyle, DR Bhandarkar, (400 BC) exc. K.V. Soundara Rajan	Carlleyle 1878: 196-226; Bhandarkar 1920; IAR 1962-63:19-20
62.	Bairat	Dausa	A. Cunningham, A.C.L. Carlleyle, D.R. Sahni	Cunningham1873; Carlleyle 1878; Sahni n.d.
63.	Garhi 26° 45' 52" N.; 78° 06' 00" E	Dhaulpur	PGW, EH and medieval, R. Saran *et al.*	IAR 1992-93: 87
64.	Isi Pura (Nidhara) 26° 39' 50" N.; 77° 35' 00" E	Dhaulpur	EH, R. Saran *et al.*	IAR 1992-93: 85
65.	Jhor 26° 41' 27" N.; 77° 52' 00" E	Dhaulpur	EH, R. Saran *et al.*	IAR 1992-93: 86
66.	Maloni 26° 46' 55" N.; 77° 55' 22" E	Dhaulpur	EH, C.L. Suri *et al.*	IAR 1991-92: 94
67.	Maraina ka Khera 26° 48' N.; 78° 02' 22" E	Dhaulpur	EH, C.L. Suri *et al.*	IAR 1991-92: 96
68.	Mishra ka Pura 26° 33' 25" N; 78° 48' E	Dhaulpur	EH, C.L. Suri *et al.*	IAR 1991-92: 95
69.	Rajaura Khurd 26° 43' 20" N; 77° 45' 00" E	Dhaulpur	EH, C.L. Suri, *et al.*	IAR 1991-92: 96
70.	Hansai 26° 47' 52 N; 77° 40' E	Dhaulpur	NBP, PGW, BRW, BSP, Micros C.L. Suri *et al.*	IAR 1991-92: 94
71.	Donder Khera 26° 42' N; 77° 45' 43" E	Dhaulpur/ Mendki/Maghi	Exc. Pre-Gupta Pd. and Early medieval Pd. Chalcoc and PGW, Ram Saran	IAR 1993-94: 91-93
72.	Kejal	Dungarpur	Late Gupta and Jaina Sculptures	IAR 1956-57: 83
73.	Bhadra	Ganganagar-Hanumangarh	Harappan, Late Harappan, EH pottery, D. Handa	IAR 1972-73: 61
74.	Jogi Ason Chak No.1	Ganganagar-Hanumangarh	Pre- Harappan, Harappan, EH, Medieval pottery and coins, D. Handa	IAR 1972-73: 61-62
75.	Nohar	Ganganagar-Hanumangarh	Pre-Harappan, Harappan, EH, Med. Pott., coins, D. Handa	IAR 1972-73: 61-62
76.	Karoti	Ganganagar-Hanumangarh	Pre- Harappan, Harappan, EH and Med. Pott. and coins D. Handa	IAR 1972-73: 61
77.	Nagar	Jaipur	ACL Carlleyle	Carlleyle 1878: 162-95
78.	Sambhar	Jaipur/Salt Lake	3rd cent B.C.-10th C. A.D.; Exc, D.R. Sahni	Sahni n.d.
79.	Gondi	Jaipur/ Bandi	PGW, NBP, B & R, ASI	IAR 1958-59: 45
80.	Amansar	Jaipur	Sunga-Kushana, P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 99
81.	Amarpura	Jaipur	Sunga-Kushana, P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 99
82.	Bhamod	Jaipur	Sunga-Kushana, P.L. Chakravarty and Vijai Kumar	IAR 1 987-88: 100

S.No.	Site Name	District/River	Comments/Explorer	References
83.	Chak-Peoplod	Jaipur	Sunga-Kushana, P.L. Chakravarty and Vijai Kumar	IAR 1 987-88: 100
84.	Dolaj	Jaipur	Sunga-Kushana, P.L. Chakravarty and Vijai Kumar	IAR 1 987-88: 100
85.	Gogera	Jaipur	Sunga-Kushana, P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
86.	Gothnari II	Jaipur	Sunga-Kushana, P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
87.	Vijai Singhpura	Jaipur	Sunga-Kushana, P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
88.	Badnagar	Jaipur	RW, Vijai Kumar	IAR 1972-73: 28
89.	Beedh ki Jori	Jaipur	RW, Vijai Kumar	IAR 1972-73: 28
90.	Kiradot	Jaipur	RW, Vijai Kumar	IAR 1972-73: 29
91.	Mandha	Jaipur	RW, Vijai Kumar	IAR 1972-73: 29
92.	Buchobharat	Jaipur/Sabi	RW, Vijai Kumar	IAR 1973-74: 24
93.	Budha	Jaipur/Sabi	RW, Vijai Kumar	IAR 1973-74: 24
94.	Duduka	Jaipur/Sabi	RW, Vijai Kumar	IAR 1973-74: 24
95.	Rajnota B	Jaipur/Sabi	RW, Vijai Kumar	IAR 1973-74: 24
96.	Chatarpura II	Jaipur	Kushana, P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
97.	Kalyanpur	Jaipur	Kushana a, Vijai Kumar	IAR 1972-73: 29
98.	Pragpura Kuradot	Jaipur	Kushana a, P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 100
99.	Jodhpura	Jaipur/Sabi	K.N. Dikshit; Exc.R.C.Agrawala *et al.* Pd. I- OCP, Pd II-, BRW, Pd. III- PGW, Pd IV-NBP, Pd. V-Sunga-Kushana	IAR 1958-59: 74; 1972-73: 28-29
100.	Gangadhar	Jhalawar	Terracotta ring wells, Arch Mus, Raj	IAR 1960-61: 66
101.	Jodhpur Sonari	Jhunjhunu	OCP, BRW, Micros, NBP, Historic, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20
102.	Rampura	Jhunjhunu	OCP, BRW, Micros, NBP, Historic, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20
103.	Sunari	Jhunjhunu/Kantli	Ex. R.C. Agrawala and Vijay Kumar, Pd. I-PGW, Pd. II-NBP, Pd. III-Sunga-Kushana	IAR 1980-81: 55-56
104.	Sonari-ka-Ghat	Jhunjhunu/Kantli	And Rang Mahal and BRW, K.N. Dikshit *et al.*	IAR 1977-78: 47
105.	Raipur ki Radhi	Kota	Gupta habitation site	IAR 1953-54: 38
106.	Didwana	Nagaur	Gupta shrine c. 5th century A.D., B.L. Nagarch	IAR 1981-82: 100
107.	Dhalop	Pali	4th C. A.D. sculptures, R. Pathak	IAR 1980-81:93
108	Richocha	Sawai Madhopur	RW (Kushana), Vijai Kumar	IAR 1971-72: 41
109.	Ghala	Sikar	Sunga-Kushana, P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
110.	Mawnda	Sikar	Sunga-Kushana, P.L. Chakravarty and Vijai Kumar	IAR 1987-88: 101
111.	Shyamwali	Sikar	Sunga-Kushana, P.L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
112.	Choru	Tonk	EH , B.M.S Parmar	IAR 1973-74: 23
113.	Pachala	Tonk	RW, Kushana a a a Bricks, Vijay Kumar	IAR 1971-72: 41
114.	Dasir Gamri	Tonk	EH , B.M.S Parmar	IAR 1973-74: 23

S.No.	Site Name	District/River	Comments/Explorer	References
115.	Rairh	Tonk	Exc. K.N. Puri,	Puri 1941
116.	Aminpura	Tonk/ Banas	Red Polished Ware, ASI	IAR 1958-59: 45
117.	Lank	Tonk/ Banas	B & R and RP ASI	IAR 1958-59: 45
118.	Ahar	Udaipur/Ahar	EH and Chalco; R.C. Agrawala, H.D. Sankalia	IAR 1954-55:14-15; 55-56:11; 61-62; Sankalia et al. 1969
119.	Karanpur	Udaipur/Katara Nadi	K.N. Puri et al.	IAR 1956-57.8
120.	Balathal 24° 43' N; 73° 59' E	Udaipur	And Chalco, Exc. V.N. Misra *et al.*	IAR 1993-94: 93-97; 1995-96: 64-70; 1996-97: 90-100; 1997-98: 145-153; Misra *et al.* 1995, 1997
121.	Jagat	Udaipur	Gupta sculptures	IAR 1956-57: 83

Table 16: Northern Black Polished (NBP) Ware sites in Rajasthan

S.No.	Site Name	District/River	Comments/Explorer	References
01	Chosla	Ajmer/Banas	And BRW, PGW, Micros, ASI	IAR 1958-59: 45
02	Au	Bharatpur	And OCP, BRW, Arch Mus Raj	IAR 1963-64: 28; 1965-66: 38
03	Dehra	Bharatpur	And BRW, PGW, Vijay Kumar, Arch Mus Raj	IAR 1966-67: 30; 1971-72: 41
04	Noh	Bharatpur	And OCP, BRW, and E Hist exca. R.C. Agrawala *et al.* Arch Mus Raj	IAR 1963-64: 28-29; 64-65: 34-45; 65-66: 38; 66-67 30-31; 1970-71:31-32; 1971-72: 41-42
05	Lachhura 26°24'N: 77° 53' E	Bhilwara	EH, N.B.P., BSP, RW, GW, historical settlement, ring wells, Ex. B.R. Meena *et al.*	IAR 1984-85: 68
06	Hansai 26° 47' 52" N; 77° 40' E	Dhaulpur	And PGW, Micros, BRW, BSP, C.L. Suri *et al.* ASI	IAR 1991-92: 94
07	Bairat/Sabi	Jaipur	K.N. Dikshit; And Late NBP, and Medieval Pd. Exc. N.R. Banerjee	IAR 1958-59: 74; 1962-63: 31
08	Gondi	Jaipur/Bandi	And BRW, Early Historic ASI	IAR 1958-59: 45
09	Jodhpura	Jaipur/Sabi	Exp. K.N. Dikshit, Exc. R.C. Agrawala *et al.*	IAR 1958-59 74; 1972-73: 28-29
10	Jodhpur Sonari	Jhunjhunu	And OCP, BRW, Micros and Historic, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20
11	Rampura	Jhunjhunu	And OCP, BRW, Micros and Historic, R.C. Agrawala and Vijay Kumar	IAR 1978-79: 20
12	Sonari ka Ghat	Jhunjhunu/ Kantali	And Rang Mahal and BRW, K.N. Dikshit *et al.*	IAR 1977-78: 47
13	Sunari 27° 53' N; 75° 56' E	Jhunjhunu/ Kantali	Exc. R.C. Agrawal *et al.* Pd. I- PGW, Pd. II- NBP, and Pd. III- Shunga-Kushana	IAR 1980-81: 55-56
14	Pachala	Tonk	Vijay Kumar	IAR1971-72: 41
15	Rairh	Tonk	Exc K.N. Puri	Puri 1941
16	Ahar	Udaipur/Ahar	H.D Sankalia *et al.*	IAR 1961-62: 45

Table 17: Sunga-Kushana sites in Rajasthan

S.No.	Site	District/River	Comments/Explorer	References
01	Aguncha	Bhilwara/Mansi	Pre-Mauryan; Mauryan, Sunga-Kushana, Gupta; Nagarch *et al.*	IAR 1980-81: 55
02.	Aman Sar	Jaipur	Sunga-Kushana, P.L. Charavarty and Vijai Kumar	IAR 1987-88: 99
03.	Amrapura	Jaipur	Sunga-Kushana, P.L. Charavarty and Vijai Kumar	IAR 1987-88: 99
04.	Bhamod	Jaipur	Sunga-Kushan, P.L. Charavarty and Vijai Kumar	IAR 1987-88: 100
05.	Chak- Peoplod	Jaipur	Sunga-Kushan, P.L. Charavarty and Vijai Kumar	IAR 1987-88: 100
06.	Dolaj	Jaipur	Sunga-Kushan, P.L. Charavarty and Vijai Kumar	IAR 1987-88: 100
07.	Gogera	Jaipur	Sunga-Kushana, P. L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
08.	Gothnari II	Jaipur	Sunga-Kushana, P. L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
09.	Vijai Singhpura	Jaipur	Sunga-Kushana, P.L. Charavarty and Vijai Kumar	IAR 1987-88: 100
10.	Ghala	Sikar	Sunga-Kushana, P. L. Chakravarty and Vijai Kumar	IAR 1988-89: 76
11.	Mawnda	Sikar	Sunga-Kushana P.L. Charavarty and Vijai Kumar	IAR 1987-88: 101
12.	Shyamwali	Sikar	Sunga- Kushana, P. L. Chakravarty and Vijai Kumar	IAR 1988-89: 76

Table 18: Kushana sites in Rajasthan

S.No.	Site Name	District/River	Comments/Explorer	References
1.	Nand	Ajmer	Kushana relief, R.C. Agrawala	IAR 1958-59: 73
2.	Badla	Alwar	Kushana Pd., A. Khanna, ASI	IAR 1981-82: 55
3.	Bajora	Alwar	Kushana Pd., A. Khanna, ASI	IAR 1981-82: 55
4.	Goth	Alwar	Kushana Pd A. Khanna, ASI	IAR 1981-82: 55
5.	Hoda Heli	Alwar	Kushana Pd. A. Khanna, ASI	IAR 1981-82: 55
6.	Khelpur	Alwar	Kushana Pd. A. Khanna, ASI	IAR 1981-82: 55
7.	Nandwari	Alwar	Kushana Pd. A. Khanna, ASI	IAR 1981-82: 55
8.	Parbeni	Alwar	Kushana Pd. A. Khanna, ASI	IAR 1981-82: 55
9.	Noh	Bharatpur	Pottery, TC figurines; exc. R.C Agrawala *et al.*	IAR 1963-64:28-29; 1964-65: 34-35; 1965-66: 38; 1966-67: 30-31; 1970-71: 31-32; 1971-72. 41-42
10.	Abar	Bharatpur	RW (Kushana) and PGW Vijay Kumar	IAR 1971-72: 41
11.	Bachamdi	Bharatpur	RW (Kushana) Vijay Kuar	IAR 1971-72: 41
12.	Bahnera	Bharatpur	RW (Kushana), W, Vijay Kumar	IAR 1971-72: 41
13.	Barso	Bharatpur	RW (Kushana), Vijay Kumar	IAR 1971-72: 41
14.	Belara (Bada)	Bharatpur	RW (Kushana) and PGW Vijay Kumar	IAR 1971-72: 41
15.	Naogaya	Bharatpur	RW, Kushana bricks, Vijay Kumar	IAR 1971-72: 41
16.	Viravai	Bharatpur	RW, Kushana , and PGW, Vijay Kumar	IAR 1970-71: 41
17.	Arwar	Bharatpur	Kushana and successive Pd., ASI	IAR 1979-80: 68
18.	Buharu	Bharatpur	Kushana and successive Pd., ASI	IAR 1979-80: 68
19.	Umrain	Bharatpur	Kushana and successive Pd., ASI	IAR 1979-80: 68
20.	Unaya	Bharatpur	Kushana and successive Pd., ASI	IAR 1979-80: 68
21	Aghapur	Bharatpur	Kushana sculptures, Arch Mus Raj	IAR
22.	Darapur	Bharatpur	Kushana terracotta figurines and sculptures, Arch Mus Raj	IAR 1970-71; 31

S.No.	Site Name	District/River	Comments/Explorer	References
23.	Vahaja	Bharatpur	RW, Arch Mus Raj	IAR 1970-71: 31
24.	Hurra	Bhilwara/Khari	RP, ASI	IAR 1958-59: 45
25.	Badnagar	Jaipur	Kushan, Vijai Kumar Arch Mus Raj	IAR 1972-73: 28-29
26.	Beedh ki Jori	Jaipur	Vijai Kumar	IAR 1972-73: 28-29
27.	Kiradot	Jaipur	Vijai Kumar	IAR 1972-73: 28-29
28.	Mandha	Jaipur	Vijai Kumar	IAR 1972-73: 28-29
29.	Buchobharat	Jaipur/Sabi	RW, Vijay Kumar	IAR 1973-74: 24
30.	Budha	Jaipur/Sabi	RW, Vijay Kumar	IAR 1973-74: 24
31.	Daduka	Jaipur/Sabi	RW, Vijay Kumar	IAR 1973-74: 24
32.	Rajnota 'B'	Jaipur/Sabi	RW, Vijay Kumar	IAR 1973-74: 24
33.	Chatarpuraa II	Jaipur	Kushana, P.L. Chakravarty and Vijai Kumar Arch Mus Raj	IAR 1987-88: 100
34.	Kalyanpur	Jaipur	Kushan, Vijai Kumar Arch Mus Raj	IAR 1972-73: 28-29
35.	Pragpura Kuradot	Jaipur	Kushana, P.L. Chakravarty and Vijai Kumar Arch Mus Raj	IAR 1987-88:100
36.		Jodhpura/ Jaipur/Sabi	Exc., R.C. Agrawala and Vijai Kumar	IAR 1972-73: 28-29
37.	Sambhar or Sakambhari	Jaipur/Salt lake Sambhar	Exc., D. R. Sahni evidence from 3rd cent B.C. to 10th cent AD.	Rai Bhaduur Daya Ram Sahni 1936- 38: 1-54
38.	Richocha	Sawai Madhopur	RW (Kushana) Vijai Kumar	IAR 1971-72: 41
39.	Aminpura	Tonk/Banas	RP, ASI.	IAR 1958-59: 45

Table 19: Rang Mahal sites in Rajasthan

S.No.	Site Name	District/River	Comments/Explorer	References
01.	Amarpur	Alwar	Kushana Pd. with RM, A. Khanna, ASI	
02.	Dungarawara	Alwar	Kushana Pd. with RM, A. Khanna, ASI	IAR 1981-82: 55
03.	Googrod	Alwar	Kushana Pd. with RM, A. Khanna, ASI	IAR 1981-82: 55
04.	Kodiya	Alwar	Kushana Pd. with RM, A. Khanna, ASI	IAR 1981-82: 55
05.	Ajarka	Alwar/Sahibi	Kushana and RM, RW, C. Margabandhu *et al.*, ASI	IAR 1980-81: 55
06.	Babiriya	Alwar/Sahibi	Kushana and RM, RW, C. Margabandhu *et al.*, ASI	IAR 1980-81: 55
07.	Bagheri	Alwar/Sahibi	Kushana and RM, RW, C. Margabandhu *et al.*	IAR 1980-81: 55
08.	Bedawas	Alwar/Sahibi	Kushana and RM, RW, C. Margabandhu *et al.*	IAR 1980-81: 55
09.	Bijwara	Alwar/Sahibi	Kushana and RM, RW, C. Margabandhu *et al.*	IAR 1980-81: 55
10.	Gangapur	Alwar/Sahibi	Kushana and RM, RW, C. Margabandhu *et al.*	IAR 1980-81: 55
11.	Jalabas	Alwar/Sahibi	Kushana and RM, RW, C. Margabandhu *et al.*	IAR 1980-81: 55
12.	Khori	Alwar/Sahibi	Kushana and RM, RW, C. Margabandhu *et al.*	IAR 1980-81: 55
13.	Ramnagar	Alwar/Sahibi	Kushana and RM, RW, C. Margabandhu *et al.*	IAR 1980-81: 55
14.	Sailkhara	Alwar/Sahibi	Kushana and RM, RW, C. Margabandhu *et al.*	IAR 1980-81: 55
15.	Sanauli	Alwar/Sahibi	Kushana and RM, RW, C. Margabandhu *et al.*	IAR 1980-81: 55
16.	Sehali Kalan	Alwar/Sahibi	Kushana and RM, RW, C. Margabandhu *et al.*	IAR 1980-81: 55
17.	Tejpura	Alwar/Sahibi	Kushana and RM, RW, C. Margabandhu *et al.*	IAR 1980-81: 55
18.	Tigaon	Alwar/Sahibi	Kushana and RM, RW, C. Margabandhu *et al.*	IAR 1980-81: 55

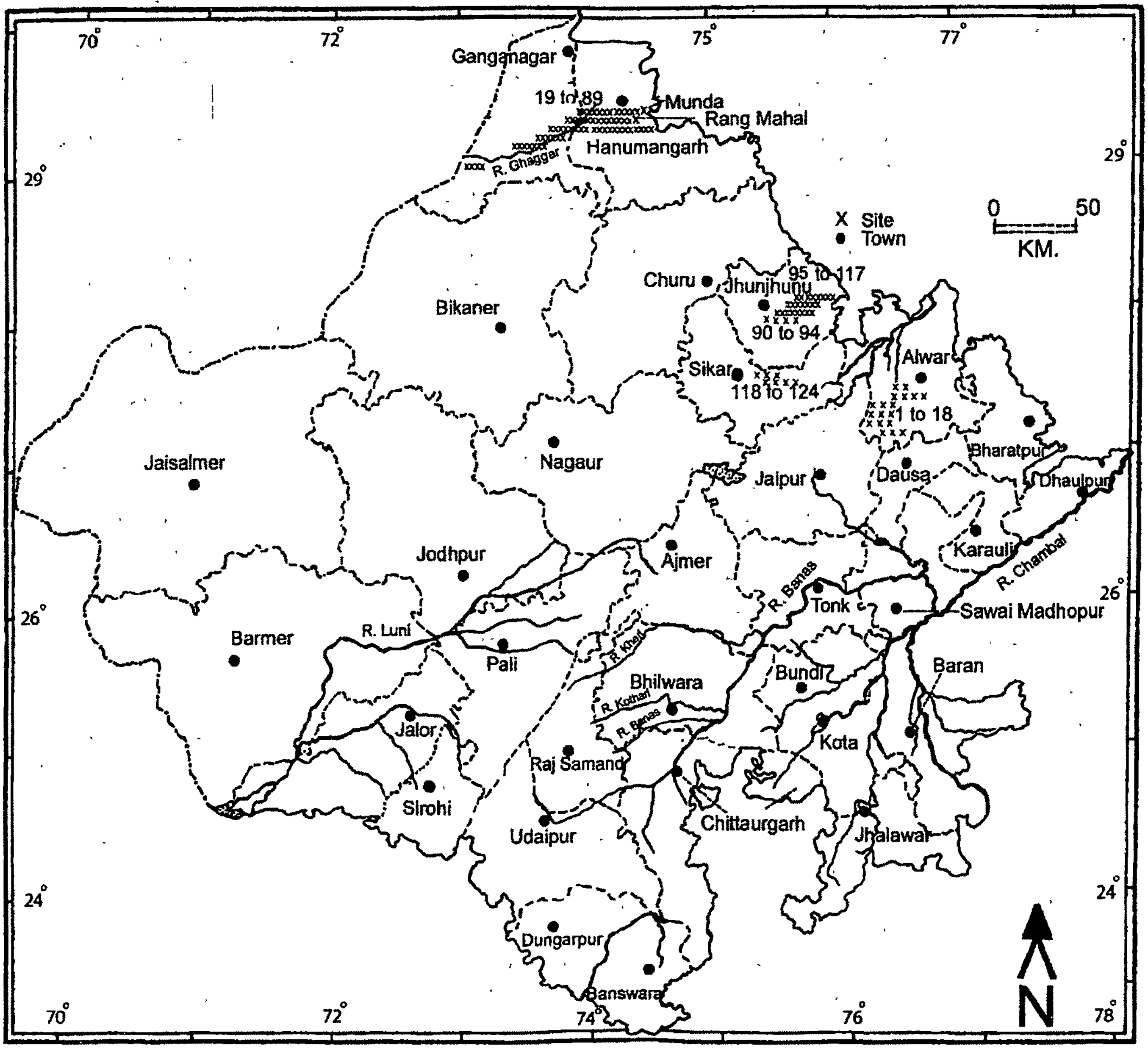

Fig. 8: Rang Mahal sites in Rajasthan

S.No.	Site Name	District/River	Comments/Explorer	References
19.	Munda	Hanumangarh/Ghaggar	18 km SW of Hanumangarh;Terracotta figurine Late Kushana Pd., Arch Mus Raj	Tessatori 1917; Stein 1989: 29-34
20.	Bamani Theri,	Hanumangarh/Ghaggar	3 km NW of Rang Mahal, A. Stein	Stein 1989: 20-21
21.	Kanisar	Ganganagar/ Hanumangarh/Ghaggar	1.5 km W of Bhawani Theri, A. Stein	Stein 1989: 20-21
22.	BhawarTher	Hanumangarh/Ghaggar	10 km NW of Suratgarh	Stein 1989: 21-22
23.	Dokal-1	Ganganagar/ Hanumangarh/Ghaggar	5 km NE of Rampura	Stein 1989: 21-22

S.No.	Site Name	District/River	Comments/Explorer	References
24.	Bhaurian Wali Theri	Ganganagar/ Hanumangarh/Ghaggar	1.5 km NW of Bhawar Theri	Stein 1989: 21-22
25.	Dokal-2	Ganganagar/ Hanumangarh/Ghaggar	5 km NW of Rampura	Stein 1989: 21-22
26.	Manik Theri	Ganganagar-Hanumangarh/Ghaggar	6 km ENE of Rang Mahal	Stein 1989: 21-22
27.	Badopal	Hanumangarh/Ghaggar	6 km E of Manik Their	Stein 1989: 21-22
28.	Panna Bishnoi	Ganganagar-Hanumangarh/Ghaggar	8 km WNW of Suratgarh	Stein 1989: 21-22
29.	Lalujat	Ganganagar-Hanumangarh/Ghaggar	8 km WNW of Suratgarh	Stein 1989: 21-22
30.	Bhagwansar	Ganganagar-Hanumangarh/Ghaggar	8 km WNW of Suratgarh	Stein 1989: 21-22
31.	Jawaiya	Ganganagar-Hanumangarh/Ghaggar	S. of Sirdargarh	Stein 1989: 21-22
32.	Sohankot	Ganganagar/Ghaggar	5 km W of Jawaiya	Stein 1989: 21-22
33.	Sirdargarh	Ganganagar-Hanumangarh/Ghaggar	16 km NW of Suratgarh	Stein 1989: 21-22
34.	Pili-bangan	Hanumangarh/Ghaggar	Tessatori; Stein	Stein 1989: 21-22
35.	Kali-bangan	Hanumangarh/Ghaggar	3 km N of Pili-bangan; Tessatori, Stein	Tessatori 1917-18; Stein 1989
36.	Dulmana	Hanumangarh/Ghaggar	3 km N of Kali-bangan	Stein 1989: 21-22
37.	Dabli	Ganganagar-Hanumangarh/Ghaggar	8 km E of Dulmena	Stein 1989: 21-22
38.	Dotheri	Ganganagar-Hanumangarh/Ghaggar	10 km W of Hanumangarh	Stein 1989 : 21-22
39.	Fattehgarh	Ganganagar-Hanumangarh/Ghaggar	5 km SE of Dabli	Stein 1989: 21-22
40.	Ekal-Theri	Ganganagar-Hanumangarh/Ghaggar	W of Hanumangarh	Stein 1989: 21-22
41.	Bhadrakali	Hanumangarh/Ghaggar	6 km E of Hanumangarh	Stein 1989: 21-22
42.	Masani	Ganganagar-Hanumangarh/Ghaggar	Near the village of Tibbi	Stein 1989: 21-22
43.	Pir Sultan	Ganganagar-Hanumangarh/Ghaggar	1.5 km N of Tibbi	Stein 1989: 21-22
44.	Khodan-wala Ther	Ganganagar-Hanumangarh/Ghaggar	1.5 km N of Surewala, close to Hissar border	Stein 1989: 21-22
45.	Red	Ganganagar-Hanumangarh/Ghaggar	Near Ramsinghpur	Stein 1989: 21-22
46	Site No. 34	Ganganagar-Hanumangarh/Ghaggar	3 km E of Binjor	Stein 1989: 21-22
47.	Jaurianwala Ther	Ganganagar-Hanumangarh/Ghaggar	NE of Bijainagar Station	Stein 1989: 21-22
48.	G.B 16	Ganganagar-Hanumangarh/Ghaggar	6 km NE of Jaurianwala Ther	Stein 1989: 21-22
49.	G.B. 12	Ganganagar-Hanumangarh/Ghaggar	10 km NE of Jaurianwala Ther	Stein 1989: 21-22
50.	Jandewala	Ganganagar-Hanumangarh/Ghaggar	3 km N of G.B. 12	Stein 1989· 21-22

S.No.	Site Name	District/River	Comments/Explorer	References
51.	Pallu	Ganganagar-Hanumangarh/Ghaggar	40 km ESE of Suratgarh	Stein 1989: 21-22
52.	Berore	Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25
53.	BGA	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25
54.	BGS3	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980 : 25
55.	BGS 4	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 25
56.	Binjor 1	Ganganagar/Ghaggar	A. Ghosh	Dalal 1980: 25
57.	Binjor 3	Ganganagar/Ghaggar	A. Ghosh	Dalal 1980: 25
58	Chak 59	Ganganagar-Hanumangarh	A. Ghosh	Dalal 1980: 25
59.	Chak 15/2	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 25
60.	Chak 15/3	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 25
61.	Chak 15/4	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 25
62.	Chak 39/1	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 25
63.	Chak 39/2	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 25
64.	Chak 40	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 25
65.	Chak 43	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 25
66	Chak 361 A	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 25
67.	Chak 58 T	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 25
68.	Chak 50	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 25
69.	Chak 21	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 25
70.	Chak 71	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 26
71.	Chak 71 T	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 26
72.	Chak 72/1	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 26
73.	Chak 72/2	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 26
74.	Chak 72/3	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 26
75.	Chak 74	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 26
76.	Chak 75	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 26
77.	Chak 77	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 26
78.	Chak 80	Ganganagar/Hanumangarh	A. Ghosh	Dalal 1980: 26
79.	Chak 86	Ganganagar/ Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 26
80.	Chak 86 IA and IB	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 26
81.	Chak 861 BX	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 26
82.	Chak 86 II	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 26
83.	Chak 87	Ganganagar-Hanumangarh	A. Ghosh	Dalal 1980: 26
84	Chak 88	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 26
85.	KLB 3	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 26
86	KLB 4	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 26

S.No.	Site Name	District/River	Comments/Explorer	References
87.	MTL	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 26
88.	Nohar	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980: 26
89.	Tarkhanewala dera	Ganganagar-Hanumangarh/Ghaggar	A. Ghosh	Dalal 1980. 26
90.	Baleshwar	Jhunjhunu/Dohan	Ancient copper mining and RM, pottery, K.N. Dikshit *et al.* ASI	IAR 1977-78: 49
91.	Danba	Jhunjhunu/Dohan	Ancient copper mining and RM, pottery, K.N. Dikshit *et al.* ASI	IAR 1977-78: 49
92.	Khetri	Jhunjhunu/ ohan	Ancient copper mining and RM, pottery, K.N. Dikshit *et al.* ASI	IAR 1977-78: 49
93.	Singhana	Jhunjhunu/Dohan	Ancient copper mining and RM, pottery, K.N. Dikshit *et al.* ASI	IAR 1977-78: 49
94.	Udaipur	Jhunjhunu/Dohan	Ancient copper mining and RM, pottery, K.N. Dikshit *et al.* ASI	IAR 1977-78: 49
95.	Aruka	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
96.	Bharunda	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
97.	Bhatiwar	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
98.	Budh	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
99.	Chhawashri	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
100.	Gada Kheda	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
101.	Gahdala	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
102.	Goribudha	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
103.	Hansalsar	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
104.	Hukumpura	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
105.	Jahaj (Pach langi)	Jhunjhunu/Kantli	RM, K.N Dikshit *et al.* ASI	IAR 1977-78: 47
106.	Kalan	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
107.	Ked	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
108.	Marot ki Pahari	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
109.	Matana	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
110.	Narhad	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
111.	Natas	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
112.	Shivanathpur	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
113.	Singhana	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
114.	Sonari-ka-Ghat	Jhunjhunu/Kantli	PGW, RM, and BRW, K.N. Dikshit *et al.*	IAR 1977-78: 47
115.	Tara-ka-Bas	Jhunjhunu/Kantli	RM, K N. Dikshit *et al.* ASI	IAR 1977-78: 47
116.	Udaipur Wati	Jhunjhunu/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 47
117.	Sonari ka Ghat	Jhunjhunu/Kantli	RM, BRW, PGW, K.N Dikshit *et al.* ASI	IAR 1977-78: 47
118.	Baleshwar	Sikar/Kantli	OCP (?), RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 49
119.	Bewa Patan	Sikar/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 49
120.	Guhala	Sikar/Kantli	RM, K N. Dikshit *et al.* ASI	IAR 1977-78: 49
121.	Khandela	Sikar/Kantli	RM, K N. Dikshit *et al.* ASI	IAR 1977-78: 49
122.	Ranasar	Sikar/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 49
123.	Shrimadhopur	Sikar/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 49
124.	Tnlokpura	Sikar/Kantli	RM, K.N. Dikshit *et al.* ASI	IAR 1977-78: 49

Table 20: Gupta sites in Rajasthan

S.No.	Site Name	District/River	Comments/Explorer	References
01	Saptarshighat Pushkar	Ajmer	3 Gupta sculptured panels, M. N. Deshpande	IAR 1962-63:18
02	Pangare	Bharatpur	Late Gupta sculptures, Arch Mus Raj	IAR 1962-63:28
03	Mataji ki Mangri	Bhilwara	Gupta, post-Gupta pottery, terracottas, B.R. Meena *et al.*, ASI	IAR 1984-85:68
04	Bayana	Bhilwara	Sculptures of Gupta Pd., S.P. Srivastava	
05	Aguncha	Bhilwara/Mansi	Pd. I- Pre-Mauryan and Mauryan, Pd. II- Sunga-Kushana, Pd. III- Gupta, B.L. Nagarch *et al.* ASI	IAR 1980-81: 55
06	Kejal	Dungarpur	Late Gupta Jaina sculptures	IAR 1956-57: 83
07	Sambhar or Sakambhari	Jaipur/ Salt lake Sambhar	Exc. D. R. Sahni 3rd cent B.C to 10th cent AD. Important finds are stone image, punch marked, Indo-Sassanian, and Indo-Greek coins	D. R. Sahni n.d. 1-54
08	Raipur ki Radhi	Kota	Habitation site Gupta Age, Arch Mus Raj	IAR 1953-54: 38
09	Didwana	Nagaur	Gupta shrine dated to c. 5th century A.D., B.L. Nagarch, R. Pathak ASI	IAR 19881-82: 100
10	Dhalop	Pali	Sculptures of 4th C.A.D.R. Pathak	IAR 1980-81: 93
11	Jagat	Udaipur	Gupta sculptures, Arch Mus Raj	IAR 1956-57: 83

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Man and Environment, 1995-2004: A Bibliometric Study

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Abstract

A bibliometric study of all articles published in *Man and Environment* from 1995-2004 was carried out. Around 17 to 26 articles were published per volume, with an average of 29-37 references per article. The number of single authored papers is slightly higher, being placed at 56.68% or 116 papers out of a total of 205 during the period of our survey. The most prolific author is P.P. Joglekar who has contributed 10 articles. Around 80% of the authors are geographically affiliated to India; and the highest number (38.35%) of authors represent universities; the most productive institution being the Deccan College Post-Graduate and Research Institute, Pune.

Introduction

A statistical analysis of social science literature produced in the form of research articles, conference proceedings, technical papers, research notes, and reviews is required in order to quantify the nature of published literature, which is the sum of current knowledge levels. A bibliometric study is one such approach which can aid in doing so.

According to *The British Standard Glossary of Documentation of Terms* (1976), bibliometrics is the study of "the use of documents and patterns of publication in which mathematical and statistical methods have been applied". In general, bibliometric analysis can be carried out on any form of quantitative analysis relating to production, distribution and use of the published or semi-published literature. The term bibliometrics consists of two distinct parts, 'biblio' and 'metrics'. The word 'biblio' is a Greek word meaning books and metrics means measurement. Therefore, bibliometrics connotes the science of measurement pertaining to books and documents.

Objectives

A bibliometric analysis of articles published in the journal *Man and Environment* from 1995-2004 has been carried out to determine:

i. quantitative growth of articles by volume;
ii. distribution of references by volume;
iii. range and percentage of references per article;
iv. authorship pattern of articles;
v. ranked list of most prolific contributors of articles;
vi. ranked list of authors by geographical affiliation;
vii. ranked list of authors by institutional affiliation;
viii. ranked list of the most productive authors;
ix. ranking of institutional collaboration; and
x. ranked list of geographical distribution of author's papers.

The Hypotheses

Considering the above objectives the following hypotheses have been formulated:

1. There is a slight variation in the publishing pattern of articles during the period under study.
2. Single author articles are more than the multi-author articles.
3. The major share of contribution to the journal is from Indian authors.
4. The majority of the authors are geographically affiliated to India.

Material and Methods

The database of this study comprises 205 articles published in *Man and Environment* from 1995-2004. The journal was first published in the year 1977. It was published as an annual issue till 1989, and thence bi-annually (June and December). It publishes original research papers, review articles, short research notes and book reviews. Topics covered include prehistoric society and past environment as well as contemporary environments and simple societies, which have relevance for studies of the past. After the selection of the journal for this study (1995-2004, 10 volumes, 20 issues), articles were recorded manually on slips. For each article, the name(s) of author(s), number of authors, number of references, author's institutional affiliation and country were noted down, All the necessary information was recorded, compiled, tabulated and analysed to fulfil the objectives of this study. The slips were then arranged and tabulated for analysis.

Analysis and Interpretation

Quantitative growth of articles by volume

Table1 reveals the total number of articles published from 1995-2004. On the whole, in ten volumes and twenty issues, the total number of articles published is 205. The distribution of articles by volume indicates that the number of articles was highest in 2002, with 26 articles. It was noted that there is slight variation in the number of articles published through the years. Therefore, the first hypothesis "there is a slight variation in publishing pattern of articles throughout the year under study" is valid.

Table 1: Frequency distribution of articles by volume

Year	Volume	No. of Articles	Cumulative Total
1995	1	22	22
1996	2	19	41
1997	3	21	62
1998	4	18	80
1999	5	24	104
2000	6	21	124
2001	7	22	147
2002	8	26	173
2003	9	17	190
2004	10	15	205

Distribution of references by volume

Table 2 shows the volume-wise distribution of references. It indicates that the ten volumes, twenty issues contained 6022 references out of a total of 205 articles. This means that every issue published 10.25 articles and each article has an average of 29.37 references.

Table 2: Distribution of reference by volume

Vol. No.	Year	No. of References	No. of Articles	Average Reference/article	Cumulative	
					References	%
1.	1995	376	22	17.09	376	6.24
2.	1996	397	19	20.89	773	12.83
3.	1997	466	21	22.19	1239	20.57
4.	1998	544	18	30.22	1783	29.60
5.	1999	866	24	36.08	2649	43.98
6.	2000	537	21	25.57	3186	52.90
7.	2001	623	22	28.31	3809	63.25
8.	2002	1150	26	44.23	4959	82.34
9.	2003	382	17	22.47	5341	88.69
10.	2004	681	15	45.40	6022	100
Total	6022	205	29.37	6022	100	

Range and percentage of references per article

Table 3 reveals the range and percentage of references per article. A total of 49 (23.90%) articles top the list, with references varying between 11 and 20. This is followed by 46 (22.43%) articles having between 21 and 30 references, 37 (18.04%) articles with between 1 and 10 references per article, 25 (12.19%) articles with between 31 and 40 references, 15 (7.31%) articles with between 41 and 50 references, 07 (3.41%) articles with between 51 and 60 references, 06 (2.92%) articles with between 61 and 70 references, 5 (2.43%) articles with between 101 and above references, 4 (1.95%) articles each having between 71 and 80 and 91 and 100 references, and finally 2 (0.97%) articles having a range between 81 and 90 references. There are 5 (2.43%) articles with no references.

Table 3: Range and percentage of references per article

No. of references per article	No. of articles	Percentage
0	5	02.43
01-10	37	18.04
11-20	49	23.90
21-30	46	22.43
31-40	25	12.19
41-50	15	07.31
51-60	07	03.41
61-70	06	02.92
71-80	04	01.95
81-90	02	00.97
91-100	04	01.95
101 and above	05	02.43
Total	205	100

Authorship pattern

Out of a total of 205 articles, 116 (56.58%) appeared as single author articles, 37 (18.04%) as two author articles, 20 as (9.75%) three author articles, 16 (7.80%) four author, 09 (4.39%) five author articles, 03 (1.46%) as six author and 04 (1.95%) as seven and above. The authorship pattern of articles shows that single author articles (56.58%) slightly outnumber multi-authored articles (43.42%). Thus, the second hypothesis "single author publication is more than multi-authored articles" is valid.

Table 4: Authorship pattern

No. of Authors	Number	Percentage
Single Author	116	56.58
Two Author	37	18.04
Three Author	20	09.75
Four Author	16	07.80
Five Author	09	04.39
Six Author	03	01.46
Seven and Above	04	01.95
Total	205	100.00

Ranked list of most prolific contributor

Table 5 shows a rank list of most prolific contributor. A total of 260 authors contributed 205 articles over period of ten years between 1995 and 2004. The most prolific authors are P.P. Joglekar who contributed 10 articles, Sheila Mishra with nine articles, A.S. Gaur with eight articles, Vasant Shinde with seven articles, nine other authors contributed five articles each, followed by three authors with four articles each, nine authors contributed three articles each, 45 authors contributed two articles and 181 authors contributed one article each. Interestingly the first two leading contributors (P.P. Joglekar and Sheila Mishra) are from the Department of Archaeology, Deccan College Post-Graduate and Research Institute, Pune. However, the third author in the list (A.S. Gaur) is from Marine Archaeology Centre, National Institute of Oceanography, Goa. Therefore the third hypothesis is "major share of contribution to the journal is from India" is valid.

Table 5: Ranked list of most prolific contributor

Rank	Author	No. of Contribution
1	P.P. Joglekar	10
2	Sheila Mishra	9
3	A.S. Gaur	8
4	Vasant Shinde	7
5	K. Paddayya	6
5	S.R. Walimbe	6
5	R.K. Mohanty	6
5	V.D. Gogte	6
5	Sushama G. Deo	6
5	Sila Tripathi	6
5	Sonali Naik	6
5	K. Rajan	6
5	S.N. Rajaguru	6
6	P.K. Thomas	5
6	Arti Deshpande-Mukherjee	5
6	V.N. Misra	5
6	P. Vijaya Prakash	5
6	Shanti Pappu	5
6	M.D. Kajale	5
6	Richa Jhaldiyal	5
6	A.K. Singhvi	5
6	Savita Ghate	5
7	Jeevan Kharakwal	4
7	Hema Achyuthan	4
7	Michael D. Petraglia	4
8	09 Authors	3
9	45 Authors	2
10	181 Authors	1

Ranked list of authors by geographical affiliation

From Table 6 it is clear that out of a total of 205 articles published by 260 authors during the period 1995-2004, 80% of them were published from India. While the remaining 20% of authors represent other countries as listed in Table.6. Therefore 80% of authors are geographically affiliated to India, followed by the U.K. with 20 (7.69%) and U.S.A. with 16 (6.34%) authors. Therefore a fourth hypothesis "most of the authors are geographically affiliated to India" is valid. Three authors each are from France and Germany, followed by Bangladesh with two (0.79%) authors. USSR, China, Australia, Nepal, Tanzania, Republic of Yemen, Republic of Maldives and Korea all had one author each.

Table 6: Ranked list of authors by geographical affiliation

Rank	Country of Affiliation	No. of Authors	Percentage
1	India	208	80.00
2	U.K.	20	07.69
3	U.S.A.	16	06.34
4	France	03	01.19
4	Germany	03	01.19
5	Bangladesh	02	00.79
6	USSR	01	00.40
6	China	01	00.40
6	Australia	01	00.40
6	Nepal	01	00.40
6	Tanzania	01	00.40
6	Republic of Yemen	01	00.40
6	Republic of Maldives	01	00.40
6	Korea	01	00.40
	Total	260	100.00

Ranked list of authors by institutional affiliation

The institutional affiliation of authors is divided into four categories; namely university, college, research institution and others. Universities top the list with a total of 107 (38.35%) articles followed by colleges, 84 (30.10%), research institutions 54 (19.35%) and finally others, 34 (12.18%).

Table 7: Ranked list of authors by institutional affiliation

Rank	Type of Institution	Frequency	Percentage
1	University	107	38.35
2	College	84	30.10
3	Research Institution	54	19.35
4	Others	34	12.18
	Total	279	100

Table 8: Ranking of most productive institution

Rank	Institution	No. of Authors	Percentage	Cumulative Percentage
1	Deccan College PG and Research Institute, Pune	76	28.14	28.14
2	Andhra University, Visakhapatanam	12	04.44	32.58
3	The M.S. University of Baroda, Vadodara	11	04.07	36.65
4	National Institute of Oceanography, Goa	10	03.70	40.35
5	Physical Research Laboratory, Ahmedabad	7	02.59	42.94
6	Banaras Hindu University, Varanasi	6	02.22	45.16
6	Tamil University, Thanjavur	6	02.22	47.38
7	Dr. Ambedkar College for Arts and Commerce, Pune	5	01.85	49.23
7	University of London, U.K	5	01.85	51.08
8	University of Delhi, Delhi	4	01.48	52.56
8	Utkal University, Bubhaneshwar	4	01.48	54.04
8	Institute of Rajasthan Studies, Rajasthan, Udaipur	4	01.48	55.52
8	Anna University, Chennai.	4	01.48	57.00
9	University of Shefield, U.K.	3	01.11	58.11
9	University of Rajasthan, Jaipur	3	01.11	59.22
9	University of Bradford, U.K.	3	01.11	60.33
9	Telugu University, Srisailam.	3	01.11	61.44
9	Sharma Centre for Heritage Education, Chennai/Pune	3	01.11	62.55
9	University of Pune, Pune	3	01.11	63.66
9	Indian Archaeological Society, New Delhi	3	01.11	64.77
9	UP State Archaeological Department, Lucknow	3	01.11	65.88
10	73 other institutions	3	34.07	100
		270		

Table 9: Institutional collaboration

Rank	Type of institution	Frequency	Percentage
1	University and college	11	19.64
2	College and research institution	8	14.28
3	College and non-affiliated bodies	7	12.50
4	University and non-affiliated bodies	6	10.71
5	University and research institution	5	08.92
5	University and university	5	08.92
5	College and college	5	08.92
6	University, college and research institution	3	05.35
6	Non-affiliates and non-affiliated bodies	3	05.35
7	Research institutions and research institution	2	03.57
8	Research institutions and non-affiliated bodies	1	01.78
	Total	56	100.00

Ranking of most productive institution

Table 8 presents the most prolific institution that produced most authors. The most productive institution is the Deccan College Post-Graduate and Research Institute, Pune. The number of authors affiliated to this institution is 76 (28.14%). The next most prolific institution is Andhra University, Visakhapatnam, with 12 (4.44%) while in the third place M.S. University of Baroda, Vadodara, with 11 (4.07%). The fourth rank was occupied by National Institute of Oceanography, Goa, with 10 (3.70%) authors. The Physical Research Laboratory, Ahmedabad, ranks fifth with seven (2.59%) authors. These five institutions constitute less than (42.94%) fifty per cent of the total authors. Out of 22 institutions listed in Table 8, 11 institutions produced more than fifty per cent of authors.

Type of institutional collaboration

In Table 9 the collaborative contributions of different types of institutions was examined and analysed. For the convenience of this study, institutions are grouped into eleven categories. The first category includes universities and colleges. The second category includes colleges and research institutions like Physical Research Laboratory, Ahmedabad, National Institute of Oceanography Goa, etc. The third category includes colleges and non-affiliated institutes. The category nine includes non-affiliated bodies such as government museums like the Cleveland Museum of Natural History, U.S.A. Ancient India and Iran Trust, and so on. It is evident from the above table that academic institutions collaboratively published papers more than twenty times, followed by academic institutions and research institutions (sixteen times; 28.57%). Universities and colleges top the list with 19.64% collaboration, followed by colleges and research institutions with 14.28%.

Geographical distribution of author's papers

In Table 10 an attempt has been made to study the geographical distribution of papers published in the journal under study. The majority of papers are from Pune (77) followed by U.K. (17) and U.S.A. (15). More than 80% of the papers are from India and only 18.90% of papers were contributed by countries like the U.K., U.S.A., France, Germany, Bangladesh, U.S.S.R., Australia, China, Nepal, Tanzania, Republic of Yemen, Republic of Maldives and Korea. The contribution of papers from outside India is less. Out of a total of 254 representations only 48 are from outside India. Of these, 32 are from U.K. and U.S.A.

Table 10: Rank list of geographical distribution of papers

Rank	Area	Frequency	Percentage
1	Pune	77	30.31
2	U.K.	17	06.69
3	U.S.A.	15	05.90
4	Delhi	14	05.51
5	Vadodara	10	03.93
6	Goa	09	03.54
7	Ahmedabad	08	03.14
8	Jaipur	06	02.36
8	Varanasi	06	02.36
8	Calcutta	06	02.36
8	Chennai	06	02.36
8	Thanjavur	06	02.36
9	Visakhapatnam	05	01.97
10	Allahabad	03	01.81
10	France	03	01.81
10	Germany	03	01.81
10	Sambalpur	03	01.81
10	Bubhaneshwar	03	01.81
10	Mumbai	03	01.81
10	Lucknow	03	01.81
11	Mysore	02	00.79
11	Hampi	02	00.79
11	Udaipur	02	00.79
11	Almora	02	00.79
11	Waltair	02	00.79
11	Thiruvanantapuram	02	00.79
11	Shimla	02	00.79
11	Manipur	02	00.79
11	Dharwad	02	00.79
11	Kanpur	02	00.79
11	Bangladesh	02	00.79
12	Chandigarh	01	00.39
12	Srinagar	01	00.39
12	Patna	01	00.39
12	Hyderabad	01	00.39
12	Kurukshetra	01	00.39
12	Rewa	01	00.39
12	Srisailam	01	00.39
12	Bangalore	01	00.39
12	Raigad	01	00.39
12	Jodhpur	01	00.39
12	Rajkot	01	00.39
12	Kurnool	01	00.39
12	Aligarh	01	00.39
12	Agra	01	00.39
12	Gorakhpur	01	00.39
12	Raipur	01	00.39
12	Solapur	01	00.39
12	Porbandar	01	00.39
12	U.S.S.R.	01	00.39
12	Australia	01	00.39

12	China	01	00.39
12	Nepal	01	00.39
12	Tanzania	01	00.39
12	Yemen	01	00.39
12	Maldives	01	00.39
12	Korea	01	00.39
		254	100.00

Summary of the Principal Findings

1. From 1995-2004 (10 volumes, 20 issues) the total number of articles published was 205. The highest number of articles (26) published are in the year 2002. It is noticed that there was a slight variation in the number of articles published each year.
2. The range of articles published per volume during the period (1995-2004) is between 17 and 26, with an average of 29 and 37 references per article.
3. Regarding the range and percentage of references per article, it is seen that a total of 49 (23.90%) articles top the list with between 11 and 20 references, followed by 46 (22.43%) articles having between 21 and 30 references; and five (2.45%) articles with more references.
4. The number of single authored papers is slightly higher at 56.68% or 116 papers out of a total of 205.
5. The top two leading contributors are affiliated to the Department of Archaeology, Deccan College Post-Graduate and Research Institute, Pune (a Deemed University). The third leading author is affiliated to Marine Archaeology Centre, National Institute of Oceanography, Goa. The most prolific author is P.P.Joglekar who has contributed 10 articles.
6. Out of 260 authors who contributed a total of 205 articles, 208 (80%) are geographically affiliated to India; followed by 20 (7.69%) who are geographically affiliated to the U.K.
7. A total of 38.35% of the authors were affiliated to universities, followed by 30.10% affiliated to colleges and 19.35% were affiliated to research institutions. Therefore highest number of authors represent university faculty.
8. The most productive institution has been the Department of Archaeology, Deccan College Post-Graduate and Research Institute, Pune, with 76 (28.14%) authors followed by Andhra University with 12 (4.44%) authors. There are 73 other institutions which produced less than three articles.
9. Academic institutions have collaborated in publishing more articles (20) followed by academic and research institutions with 16 (28.57%), university and colleges with 11(19.64%). These articles are interdisciplinary in nature.
10. Regarding geographical distribution of papers, the majority of papers published are from Pune (77), followed by U.K. (17) and U.S.A. (15). More than 80% of the papers came from India and only 18.90% of papers were contributed by foreign countries like U.K., U.S.A., France, Germany, Bangladesh, U.S.S.R., Australia, China, Nepal, Tanzania, Republic of Yemen, Maldives and Korea.

Conclusion

This analysis of published literature on various aspects of Indian archaeology, indicates that Indian research on archaeology is being carried out in several institutions and is reported in this Indian journal which has international subscribers. The majority of the contributions, as per this analysis, come from a few educational institutions like the Deccan College Post-Graduate and Research Institute, Kerala University, Utkal University, Telugu University, and Anna University. It is also inferred from the study that there has been a consistent trend towards an increase in collaboration in archaeological research due to the emergence of interdisciplinary projects, and mission oriented and specialised research activities.

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Discovery of a Megalithic Rock-cut Cave at Kodakkal, District Malappuram, Kerala

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Introduction

A megalithic rock-cut cave was accidentally discovered while digging a foundation trench at the premises of a tile factory at Kodakkal (10° 55' N; 75° 55' E). Koddakal is located close to the Tirunavai railway station. The site is around 7 km northeast of Kuttipuram by road, and 5 km southwest of the Tirur station (Fig. 1). Kodakkal is situated on the northern banks of the Ponnani River. The locality appears to have derived its name from the megalithic type, Kudai-kal, or 'hood' stone that may have existed there. The tile factory is situated on a small laterite hillock spread over nearly five acres. The uncovered rock-cut cell was located on the northeastern slope of this hillock. Since a mechanical excavator was used, the damage to the cave was extensive. The author visited the site and retrieved antiquities deposited at the police station. The finds are briefly described here.

The Cave

The scooped out portion of the rock-cut cave appears to have been its main hall or chamber. The interior of this cave was roughly rectangular with its roof supported by a monolithic shaft, broken remains of which occur at the site. The entrance to the cave was through a narrow passage from the eastern side, down a flight of steps. A large urn was apparently placed in the centre, of which sherds have been found. Local people opined that the other finds retrieved from the site were from the large urn. However, evidence from many similar sites in North Kerala indicate that pots and other artefacts were placed on benches within the cave, around the main urn, which was placed in the centre (Logan 1887: Illustration IX; Sharma 1956: 93-115). As the site is extensively damaged, any conclusive judgement is not possible. The artefacts recovered from the site include pottery and iron objects.

Black-and-Red Ware

The shapes noticed in the Black-and-Red Ware are (i) pear-shaped vases, and (ii) bowls.

Pear shaped vases

Two intact and identical pear-shaped vases were recovered from the site (Fig. 2: 1-2). The vases measure an average of 11 cm in diameter at the mouth, 39 cm in length from rim to the base and 25 cm in width at the belly. Both vases are modelled in fine clay using the coil or ring method aided probably with a turn-table and beater. The modelled vases were subsequently given a red slip, decorated and then well fired. The rim and the interior of the pot are black probably due to inverted firing. The slip is lustrous red. The rim is featureless and plain. The rim measures 2 cm and a ledge separates the rim from the body. They are separated by a distance of around 10 cm. The upper-most tiers have a band of shallow oblique parallel lines emerging at the horizontal band and oriented towards the rim. In the middle tier, two bands of oblique lines emitting from the horizontal bands converge towards the centre. Towards the bottom, similar lines emerge at the lower horizontal band and run towards the base of the pot. These striations, apart from being grooved or etched were also possibly painted in white colour though the pigments are difficult to trace. A glossy white shade is observed along the striations.

Vases of similar shape, size and decoration have very rarely been noticed or reported from the megaliths of Kerala. Hence, this discovery is noteworthy. The vases due to their bulbous base cannot be kept erect without the help of a ring stand in terracotta or a tripod-ring stand of iron. Its narrow mouth indicates that the pot possibly stored some liquid. The vase's bottle-gourd shape probably implies an association with toddy. Till very recently, toddy in Kerala was collected from palms using the dried shell of the bottle-gourd and stored in similar vessels. These vessels as seen today were inserted into a net made of string or rope with a loop-handle so that they could be carried or strung to a rod or pole. The eroded surface around the neck of the vase retrieved from here, seems to validate the fact that it was used in this fashion. Toddy and brew are also associated with funeral rituals in certain communities today. Hence, it may not be wrong to assume that these vases were used to store toddy or brew. Tests reveal that each pot is capable of carrying exactly 10 litres of liquid up to its rim. It is difficult to estimate whether

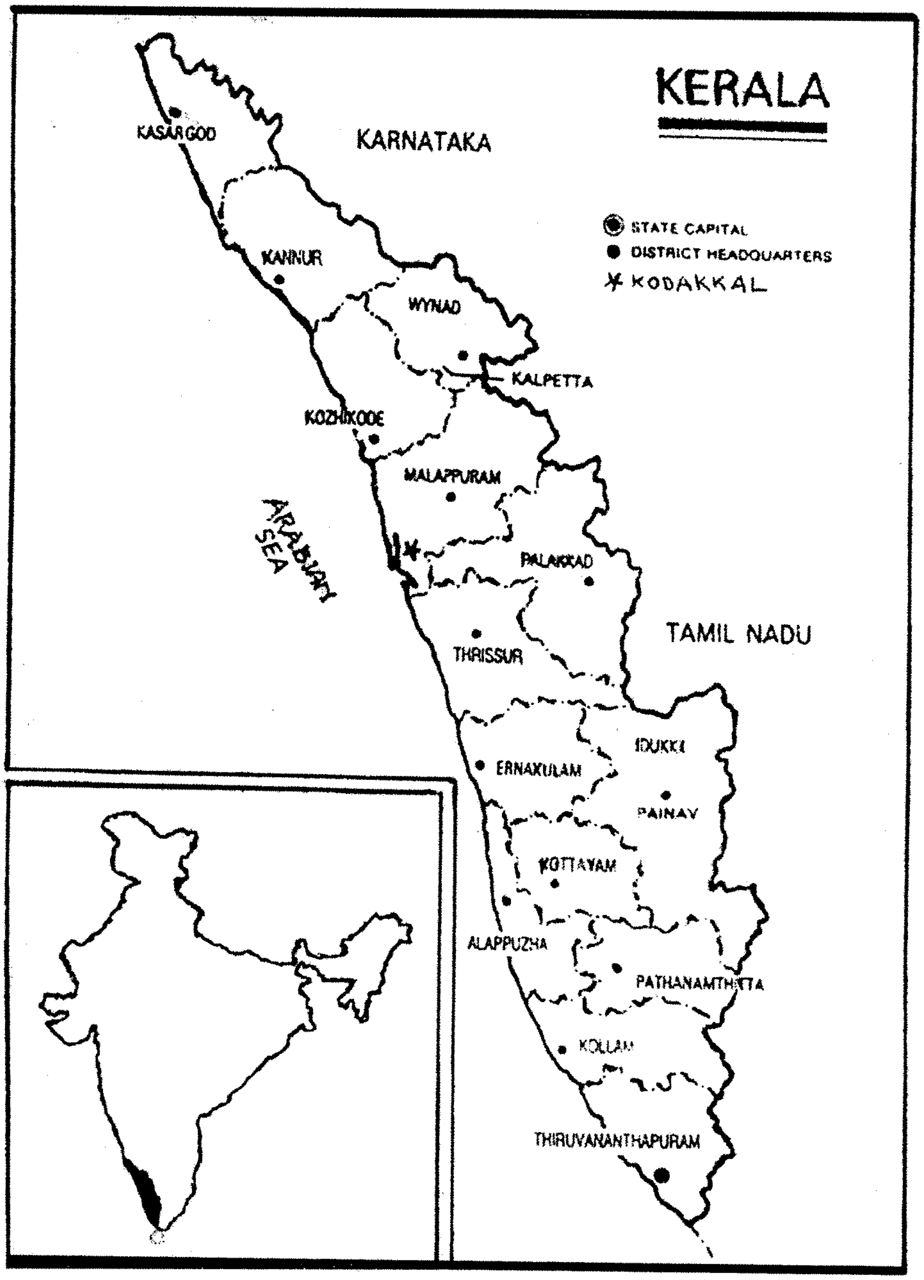

Fig. 1: Location map of Kodakkal

toddy or brew was offered to the deceased soul in these pots. A broken tripod-iron ring-stand retrieved, may have supported one of the better preserved vases. In another case, the laterite sticking to its side and the corrosive nature of its slip at this location, implies that the vase rested on its side. The vases also had the capacity to store upto 7.5 kg of cereals or pulses. The vases were provided with lids which had a rim length of 2 cm internally, perfectly tuned with the measurement of its rim. The similarity in the measurement of the vases, their lids and the filling capacity and decorations, implies that they were the creation of a single potter following some form of standard measuring system for gauging length and volume.

Bowls

The Black-and- Red Ware bowl found was broken (Fig. 2: 5). It had a diameter of 13 cm at the mouth and was nearly 10.5 cm in height. The rim is plain and featureless, and the interior is black. The exterior surface is deep red. It was perhaps used to serve or store a liquid, gruel or porridge.

Till recently, such bowls were used to serve gruel. In the absence of a ring base, the bowls were given stability by placing them in sand or soft earth. If a similar use can be assumed, the retrieved bowl had a capacity to hold nearly one litre of gruel. Bowls of similar nature are common at many megalithic sites.

Red Ware

Two shapes noticed in Red Ware are (i) four-legged vases, and (ii) globular vases.

Four-legged vases

Four-legged vases are common in the megalithic burials of North Kerala and are also reported from megalithic sites like Porkalam, Feroke and Kuttikunnu (Thapar 1952: Fig. 3; Leshnik 1974: Fig. 23; Gurukkal and Varier 1999: Fig. 20). This vase is hand made, with coarse to medium fabric and an external red slip. The rim and part of the belly of the vase are broken (Fig. 2: 3). Below the neck, the side flares up to the shoulders and then gradually tapers to the bottom which has four small hand-modelled legs. In its broken state, the vase measures 28 cm in length and the rim may have measured around 31 cm upto the rim. The maximum width at the shoulder is around 23.5 cm and at the bottom it is 12 cm, with legs each measuring 4 cm. The wide mouth of the vase implies that it was possibly used to store cereals or pulses. If so, the vase had a capacity of carrying nearly 5 kg.

Globular vase

Only the rim portion of this pot was found among the remains. It has a round mouth which is slightly flared, beaded and externally grooved (Fig. 2: 4). It was a medium-sized vessel and probably used for cooking.

Black Ware

The only shapes noticed in black ware were funnel-shaped lids. These lids were treated with black slip externally and internally, highly burnished externally and appear to be fired at a low temperature. Four funnel shaped lids were recovered from the site (Fig. 2: 6-9). They have a short vertical externally grooved rim-base with a flange on the

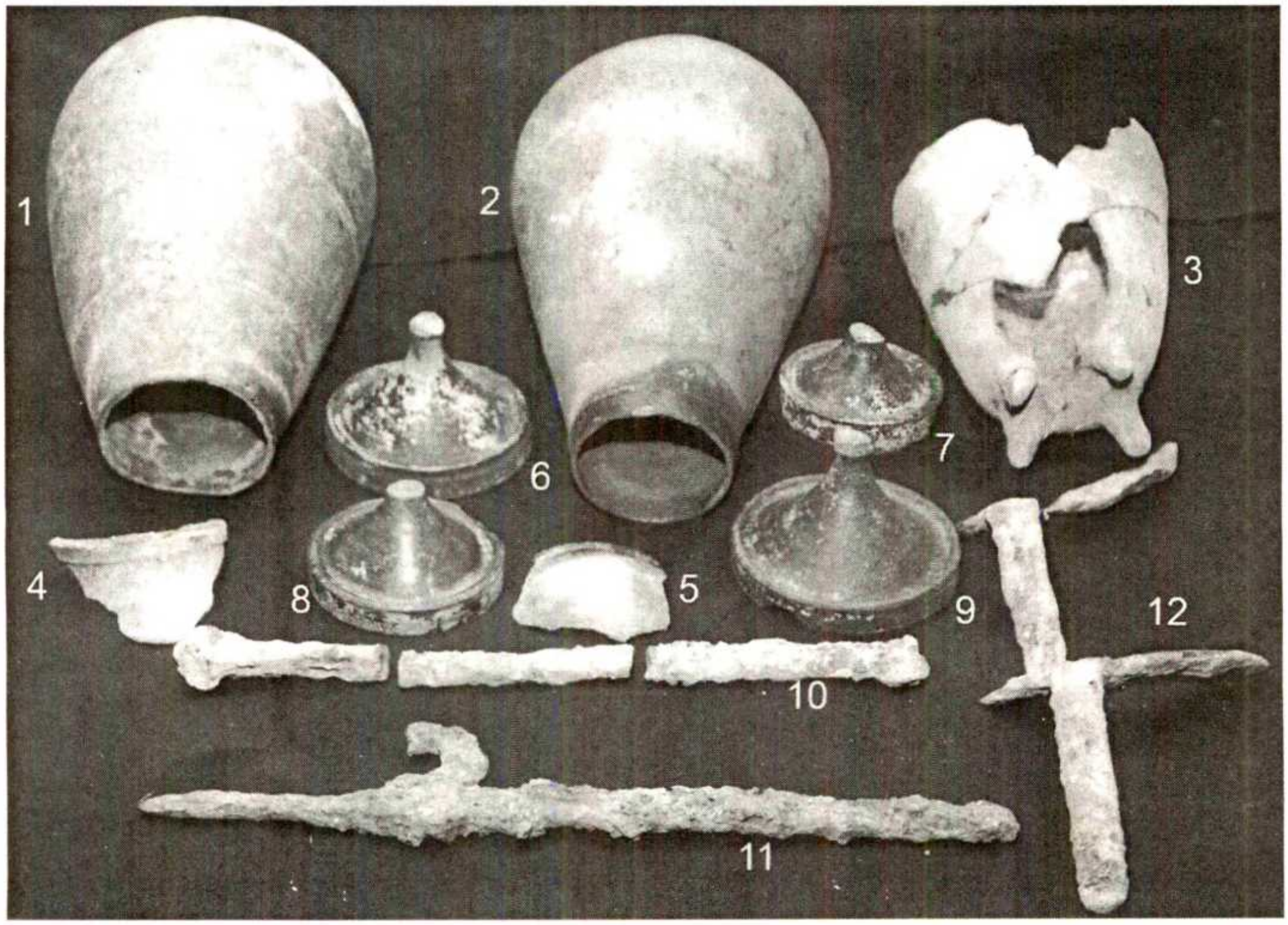

Fig. 2: Artefacts recovered from Kodakkal

inner side to accommodate the rim of the pot. Externally there is a ledge on the upper side of the rim from which the sub-conical body of the lid rises up to the handle which had a knob. The stem of the handle was hollow. The largest lid had a diameter of 15.3 cm and a height of 10 cm. The smallest was 11 cm in diameter. The rims were 2.5 cm externally in length and 2 cm internally, with a thickness of 0.5 cm. At least two of the lids perfectly matched the mouths of the pear shaped pots which also had a rim of 2 cm. Given that there were four lids, it can be assumed that there were at least four pots with lids among the assemblages in the rock-cut cave. The tendency to use lids for protecting food products from pests and predators, probably reflects the high standard of hygiene and care the megalithic folk practised in their dietary habits. Similar lids are also noticed from megalithic sites like Machad, Sanur and Porkalam (Mehta and George 1978: Fig. 5; Banerjee and Soundara Rajan 1959: Fig. 6; Thapar: Fig. 2).

Iron Objects

Among the broken iron objects recovered were two swords, and a ring stand.

Swords

Of the two swords recovered, one is fairly intact. It measures 51.7 cm from the hilt to its broken tip (Fig.2: 11). The blade has a mid-rib and is double edged and tapers to its tip. In its broken state, it measures 33 cm and may have extended another 10 cm or so. The hilt of the sword is pointed and was probably encased in wood, bone, antler or horn. The hilt is tanged on either side, which must have served as a hand-guard. Though swords have been reported form Megalithic finds in Kerala, published accounts do not reveal any of a similar nature. Hence, this sword is unique in its craftsmanship. The second sword is broken at three places (Fig. 2: 10). It has a total length of 45 cm and a blade width of 3 cm. It has a club shaped hilt and the blade slightly curves and tapers towards its tip.

Tripod ring stand

The tripod ring stand is broken and only two pieces were recovered (Fig. 2: 12). The ring has an internal diameter of 15.5 cm, a width of 3.2 cm and an external diameter of nearly 22 cm. Each foot measures nearly 16.5 cm in length and height. Similar tripod stands are also noticed in megalithic sites like Adichanallur, Chataperamba and Perungulam Ansam (Leshnik: Fig. 18, 20 and 23).

Discussion and Conclusion

Megalithic rock-cut caves are indigenous to north Kerala and some parts of South Karnataka. Though many rock-cut caves have been reported from north Kerala in the past, this discovery from Kodakkal is interesting and significant as it has yielded unique cultural artefacts. The pear-shaped vases with striated decorations and the sword with a double tanged handle have not been reported earlier from a megalithic context in Kerala and hence are unique. Apart from revealing the potters aesthetic craftsmanship and skill, the pear-shaped pots indicate the use of some form of standards in measuring length and volume. The iron sword in a fairly good state of preservation speaks of the advanced metallurgic skills of the megalithic people. Swords with hand guards have not been reported from other megalithic sites, and this makes the sword from Kodakkal distinctive. These artefacts imply that the person to whom this rock-cut cave was dedicated, enjoyed a credible socio-economic reputation.

Other assemblages from the cave like the four-legged vase, Black-and-Red Ware bowl and Black Ware lids have superficial similarities with those from some of the well-known excavated megalithic sites of Kerala and Tamil Nadu. Considering the stylistic similarity of artefacts and dates of the other excavated megalithic sites in the region, it appears that the cave and its artefacts may belong to a period between 500 and 200 B.C.

Acknowledgements

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A Preliminary Report of Excavations at the Satavahana Site of Junnar, District Pune, Maharashtra

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Introduction

Junnar (19° 12' N; 73° 53' E) is one of the important commercial towns of the Pune district, and lies about 90 km to the northwest of Pune (Fig. 1). Till the Peshwa period in the 18th century, the region played an important role in the political and administrative affairs of the Satavahanas, the Chalukyas, the Rashtrakutas, the Yadavas, the Bahamanis, the Nizamshahis of Ahmednagar; and the Adilashahi Sultanate of Bijapur. A total of 184 Buddhist rock-cut caves of the Hinayana phase are known from the hills surrounding Junnar. This is the largest group of such caves so far known in Maharashtra. Junnar is also well known for the Shivneri fort which is the birthplace of Shivaji, the great Maratha king. Naneghat, an ancient pass is about 25 km west of Junnar town. Of the rock-cut excavations at Naneghat, the main cave, which is inscribed, is the most important. On the left and right walls, a sacrificial inscription of queen Naganika of the Satavahana dynasty, is engraved. Ganesh Leni, also known as Lenyadri, one of the *viharas* in this group, has been converted into a shrine of Ganesa. It is one of the *Ashtavinayaka* (Eight Ganeshas) pilgrimage centre in Maharashtra.

Junnar was located on ancient trade routes; from Kalyan to Paithan and from Bharukatchha to Paithan. Jadhav (1980) reported, for the first time, several Early Historic sites in Junnar and its surroundings. These sites include Kusur situated south of Shivneri fort and Nirgude to the southwest of Shivneri. An Early Historic site is located at Udapur which is situated on the left bank of the river Ad (a tributary of the river Pushpavati). It is 13 km from Junnar town. An Early Historic site with Satavahana pottery was reported at Golegaon, presently within the Junnar town boundary. The most promising sites are Padli and Agar which have became a part of Junnar town (Jadhav 1980: 57, 65-66). Subsequently, the habitation site of Agar was excavated.

The Site

The site (now a flat ground) measures approximately 1000 x 500 m. It is located on the right bank of river Kukadi, on the NE periphery of Junnar town. A large part of the site is covered by the modern habitation of Junnar. The site where the excavation was conducted is located at the village of Agar. The terrace where the entire habitation is situated is the highest place in the area. At most places, the Satavahanas preferred similar locations, e.g. Nasik, and avoided rocky surfaces, which lie alongside.

The site is totally disturbed. The present habitation covers the entire site and modern earth works have removed almost 3 m of deposit. The entire site is littered with potsherds, brickbats and tiles. A *Dargah* is located in the NE corner, which is 3 m in height. In the section we found two brick wells and other cultural material. The present surface was under cultivation for many seasons. While excavating, furrow marks were found at a depth of 10 cm. The site slopes steeply towards the west, a fact which determined trench placement. The NE portion is at a higher elevation. Thus trench Nos. 1, 4-5 revealed the topmost construction levels, which were absent in trench Nos. 2-3. In these trenches, the upper-most construction phase is eroded.

The land where the excavation was conducted belongs to Shri. Borade. The excavation was conducted in 1984 under the guidance of Dr. A.P. Jamkhedkar, then Director of Archaeology and Museums, Maharashtra, and Shri R.N. Hegde, then Assistant Director, Pune region.

The Trenches

A total of five trenches were excavated (Fig. 2). The size of trenches differed according to the structures found therein. The numbers were given according to the sequence of digging. Trench 1 was dug up to 1.4 m, and trench 2 was dug up to 60 cm. Trench 3 was excavated up to 55 cm depth, whereas trench 4 was dug up to a depth of 90 cm. Trench 5 was excavated up to 80 cm. Except trench 5, all were parallel to the southern boundary of the plot. The second trench was taken near the northern boundary where a brick lined well was already exposed.

The entire deposit was loose, ashy brown and gritty due to the presence of sand, black soil, silt and at places *kankar* and *murum*. The collapsed debris increased the grittiness of the deposit. Due to the use of bricks, the debris

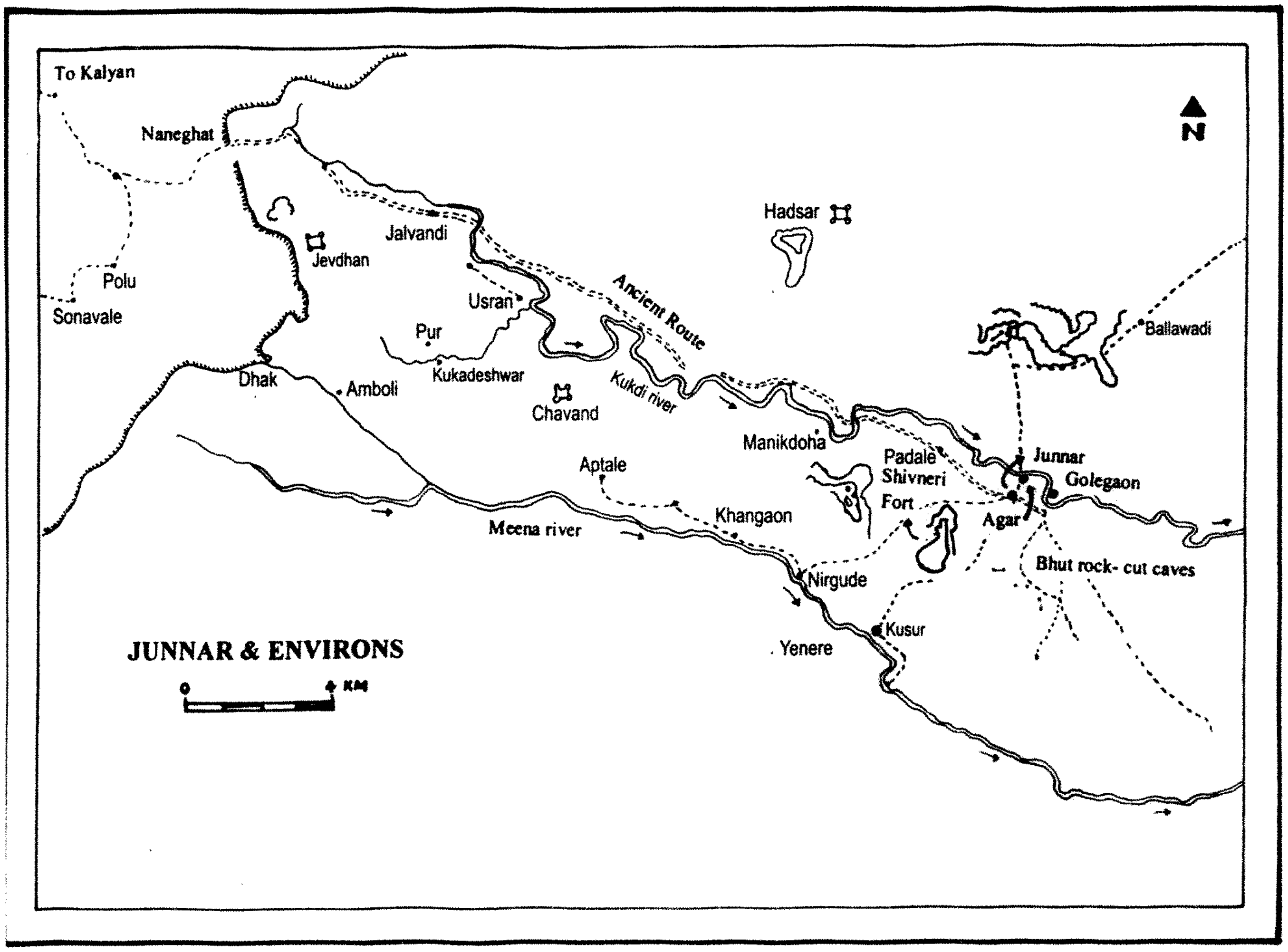

Fig. 1: Junnar and its surroundings

lying over the floor is reddish. Habitation seems to have begun right on the black cotton soil. This can be seen in the section exposed on the riverside. In the excavation, three structural phases have been unearthed. This can be seen clearly in Trench 1, which was excavated to a maximum depth. Three distinct structural phases, all belonging to one culture, were unearthed. The earliest phase was unearthed in trench 1, phase II was exposed in all trenches, and phase III was exposed in trenches 1, 4, and 5.

Phase I

This is the earliest phase revealed in trench 1. Burnt bricks were used in the construction. Mud mortar was used to fix bricks. Bricks were plastered with mud mortar. The bricks were laid in a stretcher manner. The bedding for bricks was made of stone rubble, which was fixed in the black soil. The layer of this black soil was very hard. The floor was made of lime, clay and silt mixed with gritty soil, and was rammed hard. Bedding for the floor was made of gritty soil mixed with fine gravel over the black soil, brickbats, potsherds, tiles and mud clods. Tiles having two holes on one side were used. A few pieces of calcrete were also noticed.

Phase II

Phase II was noticed in trenches 2, 3, 4 and 5. The construction method was similar to that of Phase I. The bedding of black soil was spread evenly, over which gritty soil and stone rubble were laid. Over this bedding, burnt bricks were laid. Quite a large complex of this phase was exposed in trench 3. This complex is spread over an area of about 11.45 x 8.40 m. It was disturbed as it occurs immediately below the surface. It is a square (3.60 x 2.60 m) with an extension of a single wall on the NE corner. There were four more rooms having wattle and daub walls as indicated by the remains of thin mud walls and bamboo impressed

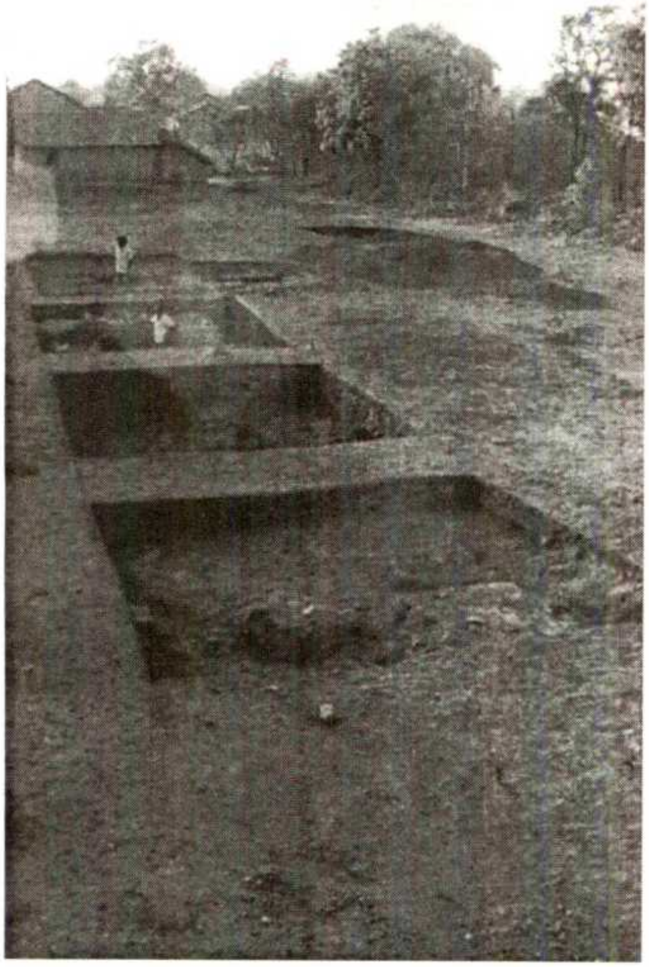

Fig. 2: Trenches

clods. The remains of the mud wall show that it was about 10 cm thick. A large jar of Red Ware was also found.

In all trenches the structures were of burnt-red bricks. Patches of floor were also noted at some places. The method of construction was the same. The size of rooms in trenches 4 and 5 were 4 x 4 m. In trench 2, a small partition wall made of wattle and daub, was recovered. There seems to have been a thatched roof over it, as the impression of the thatch over the floor was noticed.

Phase III

This level was exposed in trenches 1, 4 and 5. In trenches 2 and 3 the deposit was weathered. The construction method was the same as in the preceding phases. In trench 5 a large patch of floor was noticed.

Wells

Three brick-lined wells were exposed, two in trench 5 and one in trench 2 (Fig. 3). All these belonged to the top level, which has been eroded. The bricks (20 cm long and 5 cm thick) used for lining wells were wedge shaped. The size of bricks was 16 cm at the broader end and 12 cm at the shorter end. The wells located in trench 5 were of 1.40 and 1.38 m in diameter, whereas the well found in trench 2 was 1.02 m in diameter.

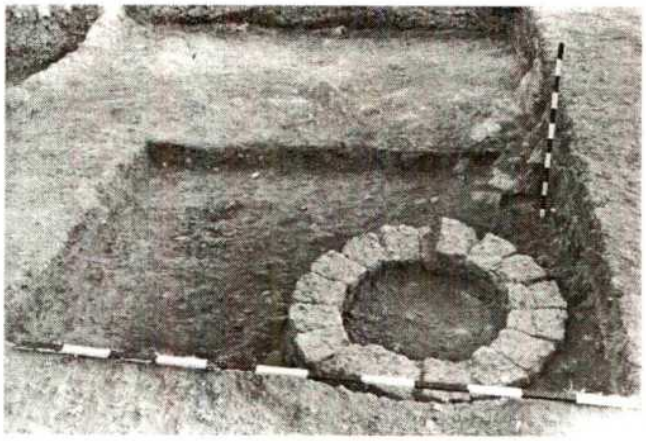

Fig. 3: Ring well in trench No. 2

Ceramic Industry

The ceramic industry consists predominantly of Black-and-Red Ware as well as Black Ware with a burnished surface, and Red Ware.

Black-and-Red Ware: This is represented mainly by bowls of different sizes. The surface is glossy. The clay is well-levigated. The core shows sufficient firing. The pots are made on a fast wheel. The thickness is even, except the base, which is slightly thicker. The black and red patches are due to inverted firing. The red colour is restricted to the belly portion or the base. The bowls have got a sharp carination.

Black Ware: There are two types of fabrics. The fine fabric pots are miniature in size, having a burnished surface. The clay is well levigated, the core shows sufficient firing. The pots are wheel-made as seen in the striation marks. The thickness is even. Pots of medium fabric are generally similar in shape with modern *matakas*. The clay is medium coarse, with additional grass and sand. There seems to be a lime admixture, might has been used as a binding material. The surface has a dull appearance. Due to insufficient firing, the surface is patchy.

Red Ware: This is represented by thin and thick sherds made of well-levigated clay and devoid of impurities. A few shreds are very thin, having stamped designs. On striking, these have a metallic ring. The pots are of small sizes. In the thick wares, the *mataka* shape, *Handi* and large jars are present. Representative shapes in the thick

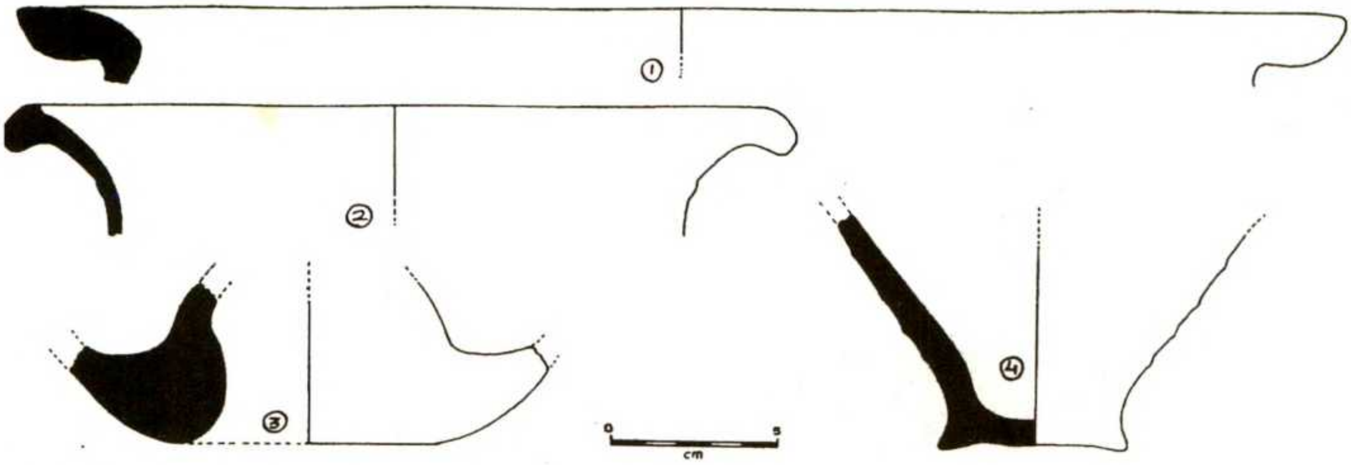

Fig. 4: Red Ware

variety are storage jars with extremely averted rim (Fig. 4:1), high-necked pot (Fig. 4: 2), stand (Fig. 4: 3) and 'V' shaped bowl with corrugated sides (Fig. 4: 4). Small pots are well fired whereas the core of large jars shows a black streak in the middle. The red slip is applied over all varieties of pots. One sherd of this variety was inscribed with the Brahmi letter 'Ma' of typical Satavahana character.

Roulletted Ware: Two sherds of the Rouletted Ware were found.

Figurines

A terracotta female figurine was found in trench 1, in layer 5 (Fig. 5). It was lying in a shallow pit (oriented EW and lying on its back with the head pointing east). The pit was filled with ash and stray bits of charcoal. The figurine is broken. The shoulder is wide and bulging and it has a prominent navel. It is not clear as to whether this was meant for worship. A fragmentary bull figurine found in trench 3 (layer 2) is made of burnt clay. All four legs are missing. One horn is incipient whereas another is turned forward. Both the horns are pointed. The figure is humpless. It may have been a toy.

Other artefacts

A few iron artefacts such as the axe, spear and nail were found in trench 5.

Implement	Layer	Description
Axe	5	triangular in shape with a pointed butt, surface heavily corroded
Spear	3	Thick, broken in 3 pieces, handle is hollow, projected ear on the left side
Nails (8)	2	pointed on one end whereas the other end is blunt, 8 cm in length and 1 cm thick
Arrowheads (2) Fig. 6	2	heavy and thick with a round body and pointed tip
Metal pieces (Fig. 7)	3	heavily corroded

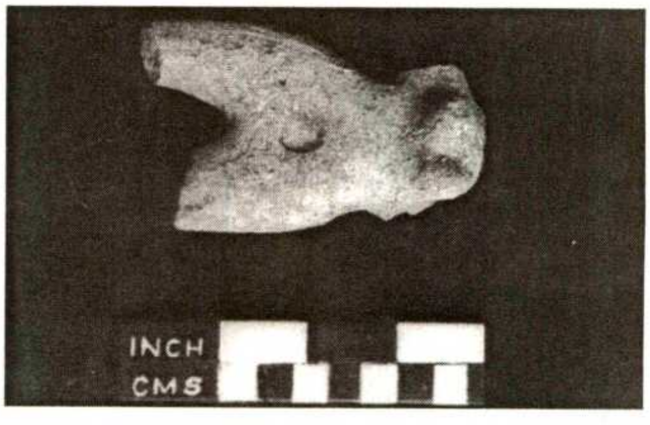

Fig. 5: Terracotta female figurine

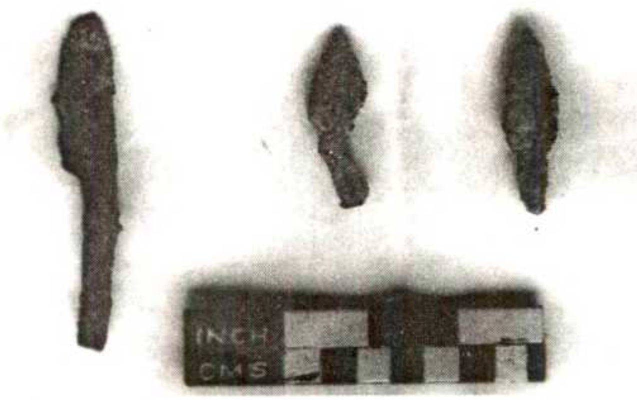

Fig. 6: Arrowheads

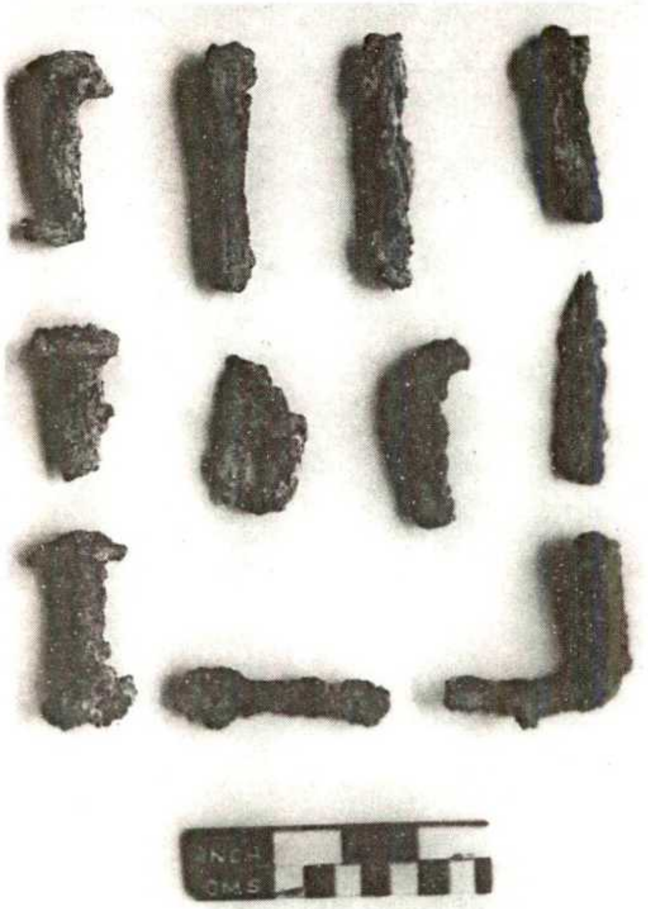

Fig. 7: Corroded iron pieces

Bone articles

These include a small, intricately carved but damaged elephant head, a bangle piece (decorated with carved bands) and a few styluses made of bone.

Beads

Beads of chalcedony, carnelian, terracotta, quartz, and bone were found. Areca-nut shaped terracotta beads were noted.

Shells

Riverine and marine shells were found in large numbers (Fig. 8). These included gastropoda and bivalves. These were used for making beads and bangles. One pendant of *Unio* shell was also found. Marine gastropods seem to have been imported from coastal areas, possibly from the Mumbai region via Kalyan.

Quartz pendant

A large and heavy pendant of pure quartz was found, which has a groove along the circumference for attaching a string.

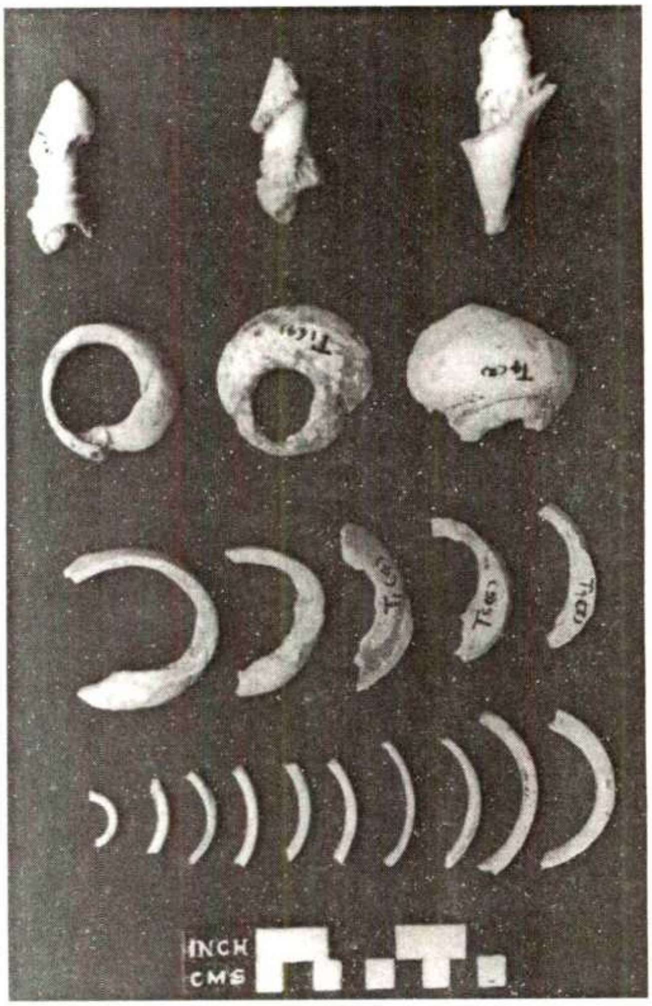

Fig. 8: Shell bangles (*Turbinella pyrum*) and shell waste from Junnar

Concluding Remarks

Many towns in Maharashtra rose to prominence in the Satavahana period. Classical writers have described Ter as the largest trading centre in the Dakshinapatha - the region south of the river Narmada. Recent excavations at Chaul, District Raigad (Gogte 2003: 70-74), Siddhapur, District Solapur (Shinde *et al.* 2004) and explorations in Satara district (Joglekar *et al.* 2003-2004) have revealed very rich cultural material of the Satavahana period. Paithan, in Aurangabad district was the capital and Nasik, Bhokardan and Nevasa were trading and manufacturing centres. Junnar in Pune district may have been the capital of Nahapana, the Khsatrapa chief (Dhavalikar 1999: 57-58). This small-scale excavation of the habitation deposit has added to our knowledge of the archaeology of the Satavahana period.

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Samudra and Sarasvati in the Ṛgveda

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Introduction

The Hindu Daily printed in several issues (18, 25 June; 9, 13 August, 2002) letters from D. Frawley and M. Witzel pertaining to (a) whether the Rigvedic people had towns/forts and knew the ocean; and (b) whether the river Sarasvati flowed down to the ocean.

In this short paper I try to show that *samudra* does denote the ocean/sea and that Sarasvati did flow to the ocean prior to 3200 B.C.[1]

a) *Samudra*: Ocean or What?

With regard to *samudra* Frawley presented some very good evidence (I 71, 7; V 55, 5; IX 84, 4 etc.) and some very dubious examples (I 130, 5; I 190, 7; VII 33, 8 etc: July 16, pp 4-6, 20-3). Witzel ignored all the sound evidence and digressed on some weak points and obvious generalities, such as — "Varuṇa is not just a god of *samudra* but… of Ṛta…".

The important point here is whether the Rigvedic people knew the ocean/sea (in our modern sense of the words) or not. If they did, then obviously *samudra* can mean ocean/sea. If they did not, then *samudra* cannot mean ocean/sea. How do we find out?

To say that *samudra* means 'ocean' and that therefore the *RV* knows the ocean (so Frawley) is circuitous and really begs the question. Similarly, to say that in one verse it means 'a terminal lake', in another 'heavenly waters', in a third 'confluence' etc, and that therefore the *RV* does not know the ocean (so Witzel), is no better.

Since the *RV* is an absolutely primary text, *philology can be of limited help to settle this issue.* When Witzel claims that philology is necessary (true of course in many ways) and refers to various sources (all distant from, and some later than, the *RV*), to recent scholarly authorities, protolanguages, and so on, and when Frawley falls into the trap and argues against all this, they both labour under a fallacy. The word *samudra* means literally 'all-together' *sam* and 'water' *udrá* (cf *anudrá* = waterless). That *udr-a* is connected to the hypothetical Proto-Indo-European **udn-*, (found nowhere except modern books!), to Gr *hudor*, Latin *unda*, Goth *watō* etc., etc., does not help us in the slightest any more than Gr *polis* and Baltic *pilis, pils* and later uses of *pur-* in India help with Rigvedic *pur.*[2] And this, because we don't and can't know if the original PIE word(s) had one meaning in all places, all tribes and all classes of the communities, and because the use of the cognates in many cases developed differently in the separate traditions according to different conditions of place and time. (E.g. Vedic *arṇa-/va* 'surging, wave, flood' is connected to Hittite *aruna* 'sea' and Gr *ernos* 'branch, shoot' and Norwegian *run(n)e* 'branch': thus, if the cognates are correct, (and who can be certain?), we have two distinct lines of semantic development. Cf also √*nu*> *navate/nauti* 'sound/praise' and 'go' but Gr *nevō* 'nod/wink' and Latin *ad-nuo* 'make a sign'; then √*man*>*manyate* 'think' but Gk *maino-mai* 'be furious', OE *mǣnan 'signify' (also mūnan* 'remember') and Goth *munan* 'think'; also *manas* 'mind' but Gk *menos* 'force/spirit'; again, *sar-ít* 'stream' or *sár-as* 'lake, pond' and Gr *hals-*'salt, sea' or *helos* 'swamp', Latin *sal-/inus* 'salt-/y', Goth *sal-sus* 'salt'. In all these examples the semantic development diverges considerably.) To say then that in *RV* VII 95, 2 *ā samudrāt* the word means 'a terminal lake' in which the river Sarasvati ends (Witzel 2001: 76) is not philology at all: it is a mere and arbitrary interpretation with the use of some reasoning or logical process which, however, here is defective because it is conditioned heavily by the AIT. That it is based on erudite studies of the past (e.g. K. Klaus, H. Lüders, *et al.*) is not at all helpful since they too are arbitrary interpretations heavily conditioned by the AIT: moreover they have no more information about *samudra* than I have or Geldner or the *Vedic Index*, since the *RV* is an absolutely primary text.

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[1] All ancient dates hereafter are BCE. Some abbreviations used· AIT = Aryan Invasion/Immigration Theory. Gk = Greek Goth = Gothic OE = Old Egnlish. PIE = Proto-Indo-European *RV* = *Ṛgveda*

[2] 2 *pur* in the *RV* never means 'fort' or 'town' but a magical, esoteric defence Merely citing verses in the *RV* but not analysing and exploring their meaning is not very sound scholarship. Here are some examples merely cited by both writers. In II, 35 the Offspring-of-Waters *Apām Napāt* is protected in *āmāsu pūrṣu* (usually translated as 'forts of unbaked bricks' even though bricks are nowhere mentioned!); the phrase means 'nonartificial natural defences' (in this case obviously 'divine'). In I 166, 8 Agastya prays to the Maruts to protect (*rakṣ-*) from evil *agha* and injury *abhihruti* the man they favour (*av-*) with 'hundredfold defences' *śatábhujibhiḥ pūrbhíḥ* no such many-walled structure existed (allowing for the hyperbole) and, moreover, it is difficult to see how people can be protected from evil by 100 fold forts/towns! VI 48, 8 is a similar prayer to Agni to protect (*pā-*) from anxiety *aṃhas* the fire-kindler with '100 purs'. clearly one cannot be protected from anxiety with 100 forts/cities (again allowing for a hyperbole) but only with internal occult defences. A final example. X 101, 8 is a prayer to Viśvedevās "to fashion inviolable metal purs" to protect the rite of soma-pouring; obviously no forts or towns are meant to be built around the sacrificial locus but magical, other-worldly defences against demons. Not one *pur* is built and not one is destroyed by human beings! See Kazanas 2003: 224-5 and n 12, also <www.omilosmeleton.gr/english/en_index html> '*Rgvedic pur*'

So how do we find out? Any mass of water more than one drop could be *sam-udra*: water in a jar, a small pool, a large lake or the sea. When we say it is a confluence or a river, we have ntroduced the element of movement — moving, not stationary water. Now, such is also water-from-a-spring, a cataract or heavy torrential rain. Perhaps *sam-udra* denotes these moving water-masses also?... Let us try a different approach — a common sense one.

For the sake of the argument, I assume that the AIT is correct. So at about 1500 B.C. the Aryans come from Afghanistan, they do manage to climb up the north-western mountains with their carts (*anas-*, *vāhana-*) and their *rathavāhana-* upon which rest the war-chariots (*ratha-*), then roll down into the valleys of Saptasindhu and with peaceful and/or violent means eventually take control of the natives. I also assume that the Sarasvati does not flow into the Indian/Arabian ocean; only the Indus does so. Meanwhile the Harappan culture is collapsing and many natives move to the east and south followed by the new-comers. The Aryans come from a landlocked place and know nothing of the ocean — only lakes, rivers and confluences. Then they begin to compose their religious hymns and a few hundred years later they arrange and produce, say c. 1200-1000, the *RV* collection — in which there is no knowledge of the ocean. This has been the mainstream AIT scenario with minor variations.

With regard to the knowledge of the ocean, this scenario contains a fatal flaw. At their arrival the Aryans may (in this scenario) have known no ocean, but is it at all likely that they continued to be ignorant of it in the next 300 or even 3 years? Of course not. They would have learnt about it from the natives, at least.

To begin with, it is well established that the Harappans knew the ocean and had maritime trade with Mesopotamia since the late third millennium if not earlier (Saggs 1989: 130; Crawford 1994: 148; Lal 1997: 182-8). They had large ports like Lothal and perhaps Dholavira (on an island) and Dvaraka (later) and obviously large ocean-faring ships and smaller craft, sailing up and down the Indus, the "terminal lakes" and the other rivers. Surely it is not likely in all those decades and centuries that the Aryans never heard from the natives about the expanse of the ocean in the south and the former trade. Then, the Aryans themselves were intrepid adventurers who had trekked hundreds of kilometres over rough and dangerous regions and had conquered the Saptasindhu. Surely it is not likely that nobody thought of travelling by chariot to the south, or by boat down the Indus (see example 5, below) and so gain first-hand knowledge of the ocean. And if a few did this, then more would follow and, in any case, knowledge of the ocean would spread among the Indoaryans, including some of the composers of the hymns.

Thus common sense compels us to accept that the Indoaryans had knowledge of the ocean/sea even in the AIT scenario. With its customary caution the *Vedic Index*, which does not at all promote indigenism or an early *Ṛgveda*, but adheres to the AIT, states "knowledge of the ocean... was almost inevitable to people who knew the Indus" (Vol 2, p. 432). Why modern scholars abandon common sense in favour of a mis-applied "philology" is a mystery.

Consequently we must accept that there may well be references to the ocean in the *RV*. Common sense again dictates that out of the many words that denote 'water-mass/flood' a very likely one is the frequent *samudra* because this is so used commonly and consistently in post-Rigvedic literature.

Are there such instances in the *RV*? Yes, many.

We should first note that the recent claims about *samudra* denoting various water-masses **SSR 2** other than the ocean are not new nor more "scientific". The *Vedic Index* (1912) mentions some scholars who rejected totally the meaning 'ocean', others who accepted it in few and others in many cases. It cites Zimmer who thought *samudra* "denotes the river Indus when it receives all its Panjab tributaries" and gives numerous references (see example no 10, end). But it adds "even Zimmer who is inclined to restrict [the Vedic Indians'] knowledge of the sea as far as possible admits it in one passage of the Rigveda and of course later" (*Vedic Index II 431*). Zimmer's one exception is VII 95, 2, (*Vedic Index* II 432), Sarasvati flowing *girībhya ā samudrāt* 'from the mountains to the ocean' (which Witzel takes as 'terminal lake')! K. Klaus (1989: 365) also agrees with Zimmer and accepts that in this passage *samudra* may denote *Meer* 'sea'. On the other hand, in some instances *samudra* can denote 'confluence' (*RV* III 33, 2) and in others primeval celestial 'ocean' (X 190, 1-2), while in yet others earthly 'ocean/sea'. Let us now pass to some examples in the *RV*. And I start with one of Frawley's examples.

1) V 55, 5 *úd īrayathā marutaḥ samudrató yūyám vṛṣṭiṃ varṣayathā* 'O Maruts, you raise up rain from the samudra [and] cause-to-rain'. Here there is plainly an upward (*ud*) movement of water/moisture/vapour and then rain caused by the Storm gods. The upward movement excludes an atmospheric or heavenly water-mass since the waters would not go even higher before they fall as rain; so it must be a water-mass on earth. The *samudra* here is singular. So it cannot be one river or confluence since there are many of these; moreover, these are in motion and even the Rigvedic people would know that vapour would rise more easily from stationary waters. Nor can it be one "terminal lake" since there are other small and large lakes. Consequently *samudra* must here denote either the sum-total of waters, stationary and moving, or a single very large watermass which is the ocean/sea. Again, the Rigvedic people must have known that evaporation occurs more in hot conditions rather than in cold; so they would not refer to *all* waters. They must also have known that it is hotter further south of Saptasindhu. Now, even in the AIT scenario, as we saw, they must have known that, further south where it is hotter, there is a very large, almost limitless watermass and that most evaporation would take place there. So here *samudra* must refer to the ocean/sea. Klaus (1989: 370) takes this as a possible reference to the Indus, but this ignores the facts given here.

The next example mentions an upper but also a lower *samudra*. I trust I shall be excused hereafter if I don't indulge in such ludicrously detailed analyses to demonstrate the obvious.

2) VII 6, 7: Agni Vaiśvānara received treasures in the rising of the sun *ā samudrād ávarād āparasmād... divā ā pṛthivyāḥ* 'from the *samudra* lower and upper, from sky/heaven and earth'. Here we have a lower and an upper ocean and sky and earth: so we take the lower ocean to be earthly and the upper one atmospheric or heavenly. Or we may also have a chiasmus figure (ad-bc: *avara-samudra* with *pṛthivī* and *para-samudra* with *dyu-*) which amounts to the same. But here the lower water-mass cannot be the heavenly one as well, nor a terminal lake nor a confluence of two rivers. Nor could the poet have in mind the sun rising from a lake or river, however wide: there was no large watermass in the east of Saptasindhu to account for such a phenomenon. So *samudra* must be 'sea/ocean' here.

We find another differentiation and contrast in a hymn to the Maruts who knew the ocean.

3) VIII 20, 25: Whatever medicinal balm is in the Indus and Asiknī rivers... *samudréṣu... párvateṣu* 'in the oceans... on the mountains'. Here now we have (two) rivers and their drinkable waters, then oceans/seas with salt-water and mountains — a totally earthly area. Thus we can exclude the heavenly ocean, lakes (with sweet water) and confluences (also sweet water).

Whatever other philologists and other experts may say about these passages, I have not the slightest doubt that they reveal knowledge of ocean/sea.

Then there is the tale of Bhujyu who is rescued by the Aśvins from the middle of the *samudra* in numerous hymns. This is all we know and post-Rigvedic literature says nothing at all about this incident.

4) I 116, 4: For three nights and three days (*tisráḥ kṣápas trír áha-*), o Aśvins, you carried Bhujyu... *samudrásya dhánvan ārdrásya pāré* 'to the distant dry-shore of the watery ocean'. Here the key is the 3 nights and days. Obviously, no lake or river is so wide that the Aśvins would need so long to ferry Bhujyu across. Only an ocean will do here. Klaus refers only to the aspect of moisture (*feucht*) ignoring all else (Klaus 1989: 366, n 12).

That the tale may be pure myth does not invalidate the duration of the Aśvins' flight to the dry *dhanva-* 'sandbank' (Mayrhofer) and the expanse of the *samudra*. Even if it is a hyperbole, it is used presumably to emphasize the expanse of waters. Consequently, in the many other references to the rescue of Bhujyu by the Aśvins *samudra* denotes ocean: eg I 118, 6; VI 62,6; VII 69, 7; VIII 5, 22; etc. Perhaps it is not out of place here to note that this motif of the Aśvins as rescuers may be PIE since it appears in Greece where the two Dioskouroi 'the bright Skygod's sons' deliver men and ships from tempestuous seas (long *Hymn to Dioskouroi* 6-8, in White 1935) and in the Baltic countries where the Dievo Sunelai 'the [sky-]god's lads' save the Sunmaiden from the sea (Ward 1968).

With these examples in mind we can look at many more passages and find they indicate knowledge of the ocean — perhaps even maritime trade in the next one.

5) I 56, 2: To [Indra] go praises... *samudráṃ ná saṃcáraṇe saniṣyávaḥ* 'as to the samudra [go] in company those desiring gain'. *saṃcaraṇa* and the plural *saniṣyavaḥ* imply more than two going together. Yes, it could be to a lake or a large river, the only one according to the AIT being the Indus (for fish, shells, commerce?). But if they have a large enough boat to take 3 or more persons and merchandise, surely it could reach the ocean in the south. However, to me (and to the *Vedic Index* I, 461-2, under **nau**) this suggests the ocean/sea.

6) I 32, 1-2: Indra killed the dragon, opened outlets for the waters splitting the breasts of mountains (1cd) then... *syándamānā áñjaḥ samudráṃ áva jagmur āpaḥ* (2cd) 'flowing directly to the ocean down rushed the waters'. Here the "mountains" may be a metaphor for clouds but even so the rainwaters would not end up in one terminal lake, or one river or one confluence (*samudra* is singular), but in the ocean. Only strong prejudice under the AIT would insist otherwise. Geldner who is obviously aware of the earlier dispute about *samudra* here translates: *eilend liefen die Gewässer stracks zum Meere*, the only difference from mine being *Meer* 'the sea' I' ll settle for "the sea" quite happily. In fact Geldner uses in his translation *Meer* 'sea' and *Ozean* 'ocean' very frequently — and even in places where I would hesitate. Here are some examples.

7) V 78, 8: *yáthā vāto yáthā vánaṃ yáthā samudrá éjati.* Geldner renders: *Wie die Wind, wie der Wald, wie das Meer bewegt* 'as the wind, as the wood, as the **sea** stirs'. Here samudra could well be a lake, but Geldner is unhesitant.

8) II 35, 3: *sáṁ anyā yanty úpa yanty anyāḥ, samānám úrvāṃ nadiaḥ pṛṇanti*: literally 'while some flow together, others flow towards; the rivers fill the common receptacle'. In Mayrhofer *ūrva* = 'dungeon', but also *Meer* 'sea'. 'Flow together' probably means flow one into the other. Geldner gives much the same but also makes an insertion in the first part:... *münden andere (ins Meer)* 'others flow (into the sea)'. And the last part he renders freely as *den gemeinsamen Ozean* 'the common ocean'.

9) III 33, 2: Impelled by Indra ... you-two [rivers] *samudrám rathýeva yāthaḥ* 'like chariot-horses go to the sea'. Geldner gives the same — *geht ihr zum Meere.* Here we could perhaps have 'you go to your confluence' since the two rivers are thought to join together; yet, even here, the simile of the chariot-horses (or, loosely 'chariots') would seem most inapt since a confluence for them would be a disastrous collision. Nor can it be said that here is meant the confluence with the Indus because this would come later, after the two rivers have joined. So we have an unclear situation.

Now Geldner not only is aware of the disputes regarding ambiguous words, phrases or passages; but also has translated all *RV* and so should know the text better than most. His numerous references to parallel passages in *other Vedic texts* shows that he knows the entire spectrum of the Vedic literature. This does not mean that he is free of errors, but these are due mostly to the limitations of the AIT which he also held but with far better reasons in his time than modern Vedicists.

Allow me here to open a parenthesis on (mis-)translations and misconceptions under the influence of this wretched AIT. In this very hymn III 33, Viśvāmitra asks the rivers Vipāś and Śutudri to stop flowing so that he and the Bharatas can cross; the rivers comply. Now in stanza 11 we find *gavyán grāmaḥ* and in 12 *bharatā gavyávaḥ*. In both cases Geldner translates the words *gav-* with *Rinder (beute) ausziehend-* 'extracting/removing (ie stealing?) cattle'. C. Watkins (2001: 86-88) translates with the compound 'cattle-raiding' ('host' in 11 and 'Bharatas' in 12). It is possible that cattle-raids did occur in Rigvedic times, as we find similar practices later in Greek and Irish texts also. But in this hymn there is no mention of any raid or cattle-stealing. The adjective *gavyu* means 'desirous-of-cattle' according to the MSD (also 'delighting-in-cattle') and Mayrhofer (*Rinder begehrend* 'desiring cattle'). The MSD gives the same meaning for *gavyat*. These meanings are not quite the same as cattle-rustling, which comes from AIT notions. *gavya(n)t-* is found in several hymn-prayers to Indra together with *aśvaya(n)t-* 'desirous-of/delighting-in horses': e.g. in IV 17, 6; VII 32, 23; etc. *gavyu* again is used also for Soma (e.g. VIII 46, 10; IX 97, 15) where the desire is presumably for the cows' milk. Surely a group of people on the move guided by a great seer need not be cattle-rustlers just because they are described as 'desirous-of/delighting-in cattle'. I would like to know if there is any clear reference to cattle-raiding in the *RV*. S.A. Dange (1967: 78-108) examined in detail many passages about the alleged "battle for the gain of cows" (*gaviṣṭi/go-iṣṭhi*) but found no evidence at all for cattle-raids and the like; it is a pity this study has not become (better) known.

I do agree with the *Vedic Index* and Zimmer that in some verses *samudra* may denote the confluence of certain rivers/streams with the Indus. E.g., III 36, 7... *samudréṇa síndhavo yādamanāḥ* '... streams uniting with the river' *(not surely uniting with 'confluence'); VI 36, 3,... samudrám ná sindhavaḥ* 'like streams/rivers to their confluence; etc.: here, yes, *samudra* could be a river or confluence. Another ambiguous passage follows.

10) I 71, 7: All offerings go to Agni *samudrám ná sravátaḥ saptá yahvīḥ* 'like the seven swift-ones flowing to the ocean'. Here, since the Indus itself is one of the 7 rivers and flows down to the ocean, *samudra* must denote 'ocean', terrestrial and nothing else. It can be argued here that *yahvī* means 'daughter' or 'she-young-one' (which is one of the two meanings given in MSD and Mayrhofer) and that the 7 rivers are "young" (i.e. smaller) tributaries flowing into the "elder" (i.e. larger) Indus. However, first, we don't know if the Indus was larger than the tributaries before it received them. Second, and more important, only a very confused mind would speak of tributaries as "young daughters". No daughters in any sense at all flow into an elder person (their mother?) the way tributaries stream into another river. Nor can it be said that several youngsters together grow into a single elder being. When Agni is described as *sáhaso yahúḥ* (IX 60, 13; or *sáhasaḥ putrá-* in V 11, 6) 'son of might', might is conceived as the pre-existing parent from whom emerges the offspring, and no poet would suggest that the tributaries emerge from the river they feed. Consequently, such thinking is as worthless as Mayrhofer says is the attempted connection of *yahu* with *Jehovah*. Thus the 7 restless riversflow with the Indus to the ocean.

Although from this we can see that the Vedic people probably had the wider (and not difficult, surely) concept of all streams/rivers eventually flowing into the ocean/sea in the south — and this is their only "terminal lake" — this is not explicit. Indeed, here *samudra* could also denote the confluence with the Indus, as we see in example 9 and other cases mentioned by Klaus (1989).

Another and final example where the word means ocean/sea.

11) X 66 11: *samudráḥ síndhū rájo antárikṣam ajá ékapāt tanayitnúr arṇaváḥ*: 'the *samudra*, the river Indus, the region/space, the midair/sky, the deity Aja Ekapaad (= the one-footed Unborn or Goat), the thunder, the flood (should listen)'. In this sequence the midair/sky, Aja Ekapād and the thunder are definitely non-earthly but atmospheric or celestial phenomena; so "the flood" is most probably the atmospheric non-earthly ocean. Consequently *samudra* cannot refer to this domain but must be a terrestrial watermass, as is the river Indus; and *rajas* is the general earthly vicinity or space. This seems to follow naturally from the preceding stanza 10c which says that waters and plants should speed the songs forward. There is absolutely nothing before or after to suggest 'confluence' for *samudra* and a pond/lake would be much too specific for this context since there are more than one of them. It cannot be 'a terminal lake' since the Indus flowed to the ocean. So *samudra* must be the normal earthly ocean. The sequence moves from the ocean/sea to the river Indus, then upward to the atmosphere/sky and its phenomena.

Now, if one examines carefully Klaus's (1989) paper on *samudra*, one will agree with some of his findings (as in the *Vedic Index*) but will also notice three methodological faults: a) he jumbles together *RV* and post-*RV* passages as if they are all of the same value; b) he refers to numerous *RV* passages and theorizes in generalities but analyses in detail very few; c) he omits several passages like those I use, eg examples 2 (VII 6, 7 yet cites VII 33, 8 etc), 3 (VIII 20, 5 yet he cites many others from Bk VIII), 6 (I 56, 2 yet cites I 52 and 55), 9 (II 35, 3 yet cites others) and 11 (X 66, 11 yet cites others). However, these latter examples show that *samudra* denotes 'ocean/sea'. As for Klaus's objection that the saltness (*Salzigkeit*) of sea-water is not mentioned, it is not serious, because there are contrasts between sweetwater streams and the ocean; no context demands anything else, nor is it anywhere stated that the river-water is drinkable. T.Y. Elizarenkova (1996: 21) contributed to this isunderstanding and misrepresentation) when she wrote "it is a problem whether the Rigvedic Aryans really new of the sea or the ocean"; in her article, which was about words denoting 'water', she did not examine any contexts for *samudra*, opted (blindly) for the meanings 'confluence, pond, spring, etc' (but not 'ocean/sea') and ignored Mayrhofer's lemma in EWA (or the KEWA Supplements) which does give 'sea' (but cited EWA for other cases). Surely, neither Geldner nor Mayrhofer are authorities to be ignored on this matter, even if one disagrees with them.

I think the evidence given above should be quite adequate. Mayrhofer in his EWA Dictionary (1996) admits now the meaning 'a large river formed by the confluence/combination *Vereinigung*) of two or more rivers'; but he also gives (and for the *RV*) *Flut* 'flood' and *Meer* 'sea' (but no "terminal lake"), as he had done earlier in his KEWA (vol. 3, 1980). I' ll settle for "sea" happily. So the Indoaryans knew quite well the earthly ocean/sea. By extension they had ocean-going ships *nāváḥ samudríyaḥ*: I 25, 7. This deserves a note. In this hymn, *RV* I, 25, Varuṇa, the god of *ṛta* 'natural order' and of the moral code, knows the paths of birds and winds, the changes of the moon, the dwellers on high, all kinds of marvels, the past and future — in stanzas 7-11; he knows also samudra-going ships. Now is it likely that the seer of the hymn puts in this last detail referring only to canoes floating on nearby,well-known streams, lakes and confluences(?!)? Is it not more likely that he has in mind ships travelling far and, like the other details, well out of the ordinary ken of the people? I think the latter and this means very distant sojourns. Evidently the seers of the hymns were more concerned with devotion and esoteric journeys than travel abroad, so they give no details about the latter. I now turn to the Sarasvati issue.

b) The River Sarasvati and Conclusion

I feel amazement every time I deal with this subject, because to me the evidence is so clear and so decisive that I cannot understand why there is so much controversy, confusion and acrimony. I shall be brief.

There is no doubt that this river flowed down to the ocean certainly before 3200.

RV VII 95, 2 states that this river flows "pure in her course from the mountains to the ocean" *śúcir yatī giríbhya ā samudrāt*. To say that here is meant some "terminal lake" is to ignore not only all the evidence presented above but also all human rationality; because in this instance the Rigvedic seer would have used different words specifically denoting a terminal lake. Vedic has *saras* 'lake' (and *hrada*); so the poet would have said *ā sarobhyaḥ* 'to the terminal lakes' maintaining the metrical cadence —⏑— (and also indicating Witzel's hypothetical etymological connexion with the name *Saras-vatī* 'having terminal lakes'); but he wrote *ā samudrāt* 'to the ocean'. Besides, how could this *nadītamā, ambitamā, devitamā* 'bestriver, best-mother, best-goddess' (II 41, 16) end in a terminal lake and so be inferior to the Indus which does flow to the ocean? It simply couldn't.

Various claims have been made that the Sarasvati was a river in Afghanistan or Iran (Iranian *Haraxvaitī*) and that the Indoaryans brought the memory of it to Saptasindhu and foisted it onto one of the rivers here. However, in this case the linguistic evidence is crystalclear. The Iranian language has *vairi-* for 'lake'. It has no cognates at all for Vedic √*sr* > *sisarti/sarati* and derivatives *saras*, *sarit* etc; it has only **harah-* in *Haraxvaitī*! This indicates that the Iranians moved out of Saptasindhu (and the *Avesta* acknowledges that they had lived in a region called *H∂ptahindu*) taking with them the name of the river

Sarasvatī and giving it to a river in their new habitat (but eventually losing the cognates *sṛ, sar-* etc. which are genuinely Indo-European as Gk *hallo-/hiallo-* and Tocharian *salate* show).

It is not only early hymns that laud Sarasvati. Late hymns VIII 21, X 64 and 177 also describe **in the present tense** the river's greatness, say that many kings live along its banks and pray for sustenance and good fortune. Neither in these hymns nor anywhere else in the *RV* is there the slightest hint that the river has shrunk, (as indeed, we find in later texts like *Manusmṛti* II 21 and scholiasts thereon). If it had shrunk, indeed, then the poets would have spoken of past glories, lamented the loss and prayed for the reappearance of the ample water; this evidently did not happen during the composition of the *RV* hymns.

The river dried up c. 1900 B.C. (Rao 1991: 77-9; Allchins 1997: 117). G. Possehl (1998) and P.H. Francfort (1992) argued that it stopped reaching the ocean before 3200, possibly **before** 3800! Consequently the (bulk of the) *RV* must be assigned to a date before 1900 and the Sarasvati hymns must belong to a period well before 3200. (Here I simplify for brevity.) The hymns evince no knowledge of large buildings, of brick-constructions, of fixed hearths/altars, of cotton, of rice and so many other elements of the Indus-Saraswati (or Harappan) Civilization, in contrast to post-Rigvedic texts that do so. Consequently they must be assigned to a period before 3000.This is in harmony with the native tradition which says that the *RV* arrangement was made on the eve of the great Bharata war just before the onset of the Kali Yuga at 3102 S.H. Levitt (2003) arrived at a fairly similar conclusion, i.e. that the *RV* was composed c3000 or some hymns before, by comparing the religious developments in India and Mesopotamia.

Is this important? Does it matter whether the *RV* was composed in the 4th millennium or c. 1000? whether the Indoaryans are indigenous or came to India c. 1500? After all, life goes on irrespective of such notions.

Yes, it matters very much. First, the aim of scholarship is to establish and promote true knowledge in all spheres so that life may be regulated by this — not prejudices, partisan views (even patriotic but false) or pet theories. Second, Indian prehistory must be restored and revalued in a correct time-frame, as is done with all other countries and all areas of History. It is sad, indeed, as Frawley wrote (2002 *The Hindu* June 18), "to note how intellectuals in India are quick to denigrate the extent and antiquity of their history". Third, the *RV* contains, apart from any historical data, ideas that are of great value to mankind and reveal, as do many other recent discoveries in prehistoric cultures (Rudgley 1998 passim), that many so-called "primitive" peoples had much and important knowledge that held them at a fairly high level of civilization enabling them to live in harmony with the natural processes of their environment. The *RV* preserves for us the idea of a Primal Unity that is the First Cause of the universe: not only in the *Puruṣa* or the *Nāsadīya* sūkta (X 90 and 129) but also in I 164, 6; III 55; VI 75,19; VIII 58; X 114, 5; and less obviously in others. This doctrine of the indescribable One, which exists before all things and is the cause of all manifestations of divine and mundane phenomena, is absent from all other Indo-European traditions (Hittite, Greek, Roman etc.);[3] it may well have been an essential constituent of the PIE culture, lost by the other IE branches. Thus the ancient Indoaryans would seem to belong among the most highly cultured people on earth with a culture that consisted not so much of material artifacts but of inner knowledge and spiritual strength: *bráhma várma mámāntaram* 'the holy-power is my inner defence' *RV* VI, 75, 19.

I think it a great pity that native Indian scholars today, and particularly sanskritists, do not throw into the dustbin of History the noxious AIT and notions rooted in it.

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[3] Th Mc Evilley finds "monism" in just about every pre-Socratic philosopher, Plato etc, as well as Egypt and Mesopotamia and connects this with monism in ancient Indic texts (2002 passim) He does not realize that Vedic monism differs radically in two essential respects First, the Vedic Absolute brahman is not one of many gods raised to supremacy by some influential priesthood or sect at a particular period and place nor some material element like water or air (as was the case with the Near Eastern and Greek cultures), but It is the Self of the universe, the First Cause of all, transcendent and indescribable, beyond all mental conception. Second, the true Self of man a atman is at all times identical to the Absolute and, therefore, only by knowing himself can man know Reality and First Cause and so the true causes and nature of the universe No text in the Near East or Greece has this monism; it will appear towards the end of the 1st or the beginning of the 2nd century CE in the Gnostic (= proto-Christian?) and Hermetic writings and later (3rd cent CE) in Plotinus

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Ṛgvedic *Pur*

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The word *pur* occurs in the *RV* (= *Ṛgveda*) more than 70 times, when compounds *pūrbhíd* and *puraṃdarā* are put aside. Mayrhofer (1956-) rightly questions a relation with *piparti*[1] 'füllt, fills' but surprisingly makes no connection with *piparti*[2] 'rettet, schütz/saves, protects'; the ancient *Dhātupāṭha* gives √*pṛ pālanapūraṇayoh* 'in the sense of protecting and filling', where obviously the first meaning connects with *pur*.

The word is variously translated as castle, citadel, fort, fortification, fortress, rampart, stronghold, wall and city or town. It is recognized as cognate with Greek *ðüëéò polis*, Lithuanian *pilis* and Lettish *pils*, all three meaning 'town, fort'. However, a careful examination of the use of *pur* in the *RV* (with the aid of A. Lubotsky's *Concordance*... and the *Vedic Index*) shows that it has only the meaning of defence or protection. Take the example of Śuṣṇa's 'mobile' *cariṣṇu pur*, VIII 1, 28. None of the structures mentioned above can fit here: no such structure in the Rigvedic material world is mobile and, in any case, this *pur* belongs to the demon of drought, a supernatural figure. (It was once suggested that *pur* might be a chariot, but *pur* is a defensive structure and not offensive like the chariot.) K. Geldner (1951-57) translates *wandelnde Burg* 'mobile/mutable town/fort' and adds in a note (28a) *die Zauberburg* 'the magical Burg' which seems correct (1951-7). He helps further by giving two references: (a) I 121, 10 is ambiguous because it speaks of light and darkness, of Śuṣṇa's *ojas* 'might' and of his *phaliga* which has uncertain meaning but has been thought to be 'cloud' or 'cave'; (b) V 31, 7 is unambiguous in that it lauds Indra's strength shown in killing the serpent Ahi, in arresting Śuṣṇa's *māyā* 'magic, occult power' and in driving away the Dasyus. *Māyā* will be discussed later on but we can note here that it is not unconnected with *pur*. Then, ṛṣi Agastya prays (I 166, 8) to the Maruts (regarded as Storm-gods) to protect (*rakṣ*-) from evil (*agha*) and injury (*abhihruti*) the man they favour (*av*-) "with hundred-fold purs *śatábhujibhíḥ pūrbhíḥ*": here too no physical structures with hundred walls or folds could possibly protect a man from evil (sin or impurity) and injury; no such many-walled structure existed (allowing for a hyperbole) and, in any case, the Maruts are not builders. Here, however, Geldner (1951-7) gives *Mit hundertfachen Burgen* 'with 100 fold Burgs (= towns/forts)' — which means nothing. Of course it could be argued that the use here is metaphorical, but we shall find that in all instances the use is "metaphorical" and that *pur* rarely denotes unambiguously a material fortification and nowhere a town. Most frequently it denotes a supernatural, occult or magical protective force or field.

In a reply to M. Witzel, D. Frawley (2002: 13) thinks that the *RV* is connected with a "semi-urban culture like the Harappan". He states: "the term *pur* for city (a term that obviously means city in Greek thought, i.e. Pura = Polis) is common throughout the text [of the *RV*]". The Greek and Baltic cognates being far too distant cannot furnish acceptable evidence for Rigvedic usage any more than the later use of *pur/pura/purī*; so all this must be disregarded in respect of the *RV*. However, as was indicated earlier, a metaphorical use of a material defensive means should not be ruled out. Starting with a simple protective bulwark (even a hump on the ground or a fissure) this developed into an elaborate defensive wall protecting a human settlement; this in turn extended to the human settlement, i.e. a town/city fortified. This is well reflected in the Greek *akro-polis*, usually the fort a little above the urban area, or in the later Indic *-pura* 'a (fortified) town', as in Hastinā-pura, Jai-pur(a), etc. But in the *RV pur* has no such significance.

Frawley continues, "Both the Vedic people and their enemies have a hundred, i.e. several [purs] (*śatapura* e.g Rigveda 6.48.8, *RV* 2.4.6; *RV* 4.27.1)". The first reference VI. 48,8 is a prayer to god Agni to protect (*pāhi*) from anxiety (*aṃhas*) the one — who-kindles-the-fire with *śatáṃ pūrbhíḥ* "a hundred purs" — whatever *pur* might be. Frawley is misreading the text, which *does not* say there are 100 'cities' but that a specific type of person should be protected with 100 *purs*; obviously, as above, a fire-kindler can't be protected from anxiety with 100 forts or cities! The second reference is to Indra crushing the 100 purs of Śambara, a much repeated motif in the *RV*. If Śambara is not a native aboriginal king against whom the Aryans are fighting (and Frawley like myself does not believe any such thing) but is a fiend or demonic figure in a magical, *non-material* dimension of the world we know, then his 100 (or 99) *purs*, prove nothing about the existence of actual Aryan cities. The third reference is again to 100 *purs* but these are *āyasī*, i.e. of metal (copper, bronze?), and surely the Vedic people had no metal-made cities. What is more, these 100 metallic *purs* are said to guard/confine/conceal (*rakṣ*) the celestial Eagle (or some such divine figure). There is no conceivable sense in which 100 cities could possibly do such a thing; here Geldner translates *hundert eherne Burgen* '100 bronze Burgs' but connects them with demons (*Dämonen*, n 1c). (Further down, note 2, I consider the possibility that these purs are within the womb *garbhe*.) Consequently all three references (and one could quote several more just as inapt) do not indicate that there were cities in the ordinary world of the *RV*. However, Frawley refers also to "the Vedic city or *pur* as 'wide, broad and extensive" (in *RV* I 189,2). But in this hymn also the poet prays to Agni to lead him and his clan or people afresh and with prosperity (*svastibhiḥ*) beyond all difficulties and become (*bhávā*) a *pur* "wide, broad and extensive" for them and their offspring (*tokāya tánayāya*). It is again inconceivable that Agni would become a "city". So Frawley's interpretation of *pur* is wrong.

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[1] If one thinks the Rigvedic people lived in towns and had forts, one should look for other kinds of evidence — though I think there is no indication of urban structures in the *RV*

[2] Here Geldner and others think that demons hold imprisoned the Eagle in these metal forts. This is possible, of course Truth is that this myth with its various interconnections is lost to us There is not enough information in the *RV* to enable us to reconstruct it even approximately. Post-Rigvedic sources with their fragmented references already indicate that they no longer have it complete or understand it fully For references, see *Vedic Index* under 'Vāmadeva' I find most interesting the re-occurrence of the verse *RV* IV 27, 1 in *Aitareya* Upanishad II 1, 5 and its interpretation there The Upanishad suggests that here the spirit of seer Vāmadeva is confined and breaks free

R.S. Bisht (1999/2000), the eminent archaeologist, excavator at Banawali, also takes *pur* to be 'city/town'; this is one of his main points of convergence between the *RV* and the Harappan or Indus-Sarasvatī Civilization. He (Bisht 1999-2000: 410-411 and n 190) gives a long list of references assuming *pur* to mean 'town' but does not apply philology to analyse contextually any one of them: the mere repetition that *pur* indicates a town/fort proves nothing. What is worse, there are mistranslations of some passages in the *RV* where the indeclinable *purás* 'before, in front' (with uddāta on the termination) is (inadvertently?) taken as the nom/acc pl *púras* 'towns' (with accent on the stem). Also, he should know there is no evidence of Harappan 'hundredbuttress forts' and metallic ones (*āyasī pur* in *RV*) nor of towns destroyed by human violence (e.g. fire). The *RV* is definitely pre-Harappan on two very significant counts (and others, less important). First, it knows not rice *vrīhi*, so essential to later rituals, cotton *karpāsa*, silver *rajata-*, brick *iṣṭakā* and fixed hearths/altars (amply attested in the Brāhmaṇas and/or Sūtras) — all of them important items of the Harappan culture. Second, the Sarasvatī river dried up almost completely by c. 1900 B.C., and *RV* VII, 95, 2 says that the river flows "from the mountains to the ocean". So the *RV* is earlier than 1900 B.C. However, G. Possehl (1998) another expert on the Indus Civilization examined all the palaeoenvironmental and geological data relevant to the Sarasvatī and concluded that the river could have flowed down to the ocean only before 3200 *at the very latest*, preferring a date closer to c. 3800! P.H. Francfort (1992) had arrived at a similar conclusion six years earlier. Between, say, 3200 and 1900 the river stopped flowing into the ocean and went through further stages of dessication. So, on this evidence, the *RV* is pre-Harappan; it is the Brāhmaṇas that converge with early Harappan phases. We should note that in a recent article S.H. Levitt (2003) by comparing the development of religious themes and images in the early Mesopotamian and Vedic traditions arrives at the same conclusion, namely that the early *RV* may well be before 3000 B.C. That the Rigvedic people, the five traditional tribes, lived in communities is undoubted. Although nomads should not be excluded, many of the communities were settled along the banks of the seven rivers and chiefly the Sarasvatī (*RV* III, 23, 4; VI, 61, 12; etc). They had agriculture, as is testified by hymns IV, 57 (to *kṣetrapati* 'Lord of the field/soil'), VIII, 91, 5 (girl Apālā and her father's field), X, 101, 3 (cultivation) and by so many implements — *khanitra* 'shovel', *lāṅgala, sīra* 'plough', *sṛṇī* 'sickle', etc Then, they were weavers with loom, shuttle, warp and woof (*RV* I, 134, 4; II, 36, 6; VI, 9, 2-3; etc). They also had metallurgy and smithies of sorts (IV, 2, 17; V, 9, 5; IX, 112, 2; etc). All such activities imply a settled people, not nomad pastoralists (as the distorting Aryan Invasion Theory would have them). But the towns of the Harappan mature or late phases are a far cry from the Rigvedic settlements — which are more accurately reflected in Plato's early ideal community, leading a simple agricultural life, eating barley-bread, drinking wine in moderation and singing hymns to the gods (*Republic* 372E). The word *pur* provides no evidence at all for the existence of towns or forts (as in historical times) in the Rigvedic world, as is shown in this study, though some crude material defences were used at times.

I shall not tire the reader with other writings which claim that *pur* denotes 'city/fort' or any of the meanings listed above (see particularly W. Rau 1976 and Mayrhofer 1996). I shall only advert briefly to the *Vedic Index* (I, 538-9), which also refers to I 189, 2 with its *prithvī bahulā na urvī pur*, stating that this "fortification" must have been "of considerable size": I dealt with this in an earlier paragraph. This valuable work notes that "a fort 'made of stone' (*aśmanmayī*) is mentioned", also "strongholds of iron (*āyasī*).. but these are probably only metaphorical". It refers to the "Autumnal (*śāradī*) forts" which "apparently" belong to *Dāsas*, perhaps "against Aryan attacks or against inundations in that season," and to forts "with a hundred walls (*śatabhunjī*)". It concludes by mentioning the "siege of forts" in post-Rigvedic Saṃhitās and Brāhmaṇas and that fire was used in these sieges according to *RV* VII 5,3.

This is a good brief summary but the comments in the *Vedic Index* are misleading since they are based on the Aryan Invasion Theory. Starting with the last point — the use of fire during sieges is imaginary. It is well established now that no Harappan towns had been sacked by allegedly invading Aryans. *RV* VII 5,3 says merely that the 'dark tribes' (*víśa ásiknīḥ*) fled in disarray for fear of Agni Vaiśvānara, the god (not ordinary fire, surely) who shone glowing while 'rending' (*darayan*, not 'burning down') their purs. The 'dark tribes' could be fiends or fears active at night and/or evil, demonic forces.

The references to later texts concern conflicts between *asuras* 'demons' and *devas 'gods'*. In fact, in *Aitareya Brāhmaṇa* I 23 the Asuras made the earth a copper/bronze (*ayasmayī*) *pur*, the Midspace (*antarikṣa*) a silver (*rajatā*) *pur* and the sky a golden (*hariṇī*) one. Obviously these *purs* have nothing to do with any kind of human towns or citadels. The same Brāhmaṇa, a little further on, II 11, says that the gods, in order to protect their sacrifice from the Asuras, placed around the sacrificial post three *purs agnimayī* 'made of Agni'. Surely it would be absurd to suppose that Agni built three 'fortifications' of stone or metal or mud or wood round the post. In fact this same passage explains that the repulsing of the Asuras is done by taking the holy fire round the place thrice (*paryagni kurvanti... tripuraṃ paryasante*)! Here surely we have a kind of ritual magic. And the same is found in *Taittirīya Saṃhitā* II 5, 3 where if a man comes under attack of witchcraft (*abhicaryamāṇa*), he should perform the ten-night-ritual and thereby surround himself with the protection of a *devapur* 'divine *pur*'! In the same Saṃhitā VI 2, 3 the Asuras had three purs, the lowest being of copper, the next of silver and the highest of gold: Rudra cleft them with an arrow made up of the powers of Agni, Soma and Viṣṇu.

The *pur* of stone (*aśmanmayī*) occurs only once in *RV* IV 30,20, where Indra overthrew 100 of them for the benefit of his protegé Divodāsa, a liberal offerer. On the face of it these stone-forts would seem to belong to human enemies of Divodāsa. But from other references to this incident (I 51,6; 112,14, the Aśvins help here; 130,7; etc, but especially II 14,6 and 19,6) these *purs* belong to the drought-demon Śambara. So even these cannot be said to be in any way ordinary human forts (or cities) built of stone.

I submit that the *aśmanmayī pur* no less than the *āyasī* 'metallic' one is metaphorical denoting a degree of hardness and colour or some such quality (like the silver and golden ones in *Aitareya Brāhmaṇa* and other post-Rigvedic texts).

The references to metallic *purs* are many. One at least says that Indra with the bolt in his arms killed the Dasyus and brought down (*nitārīt*) [their] metallic *purs* (II 20,8). Here we might think the Dasyus are local aborigines destroyed by the invading Aryans, but they had no metal-forts, surely. We can say that this is a metaphor and refers to hardness and/or colour also. But I don't see why the poet should describe an ordinary fortification of stone+mud+wood as "metallic". Stone is just as shiny and hard as the metal *ayas* and mud or wood or both can hardly be shiny or hard like metal. (We don't really know what is involved exactly since the construction and constitution of the *purs* are nowhere given in the *RV*.) Moreover it is Indra, a super-natural force, that destroys them — not men's weapons. Let us see the other references. We have already examined the 100 metal-forts that guarded the Eagle (IV 27,1): here these forts are in the womb *garbhe* (or under the charge of demons).[2] Then three references (I 58,8; VIII 3,7 and 15,14) are prayers to Agni to protect the poet (and his people) from various calamities including anxiety *aṃhas* (I 58,8) with *purs* of metal. Another one, X 101,8, is a prayer to the Viśvedevās to "fashion (*kṛṇudhvam*) inviolable metal *purs*" in connection with the pouring of the soma-drink; since only demons interfere with the sacrifice, the required purs would be of such substance as to stop those other-worldly forces. Another one (VIII 95,1) calls the river Sarasvatī "a metal *pur*" which is a secure support/defence (*dharuṇa*). In yet another one (VIII, 100,8) the Eagle (*suparṇa* here) pierced the metal *pur* with the speed of mind, flew to heaven and fetched soma to the Boltbearer. All are non-material *purs* including those of the Dasyus in II 20,8. The three of Agni and the one of the Viśvedevās are certainly magical or super-natural in some way.

However, the reference to the seven purs of the enemies of king Sudās in VII 18, 13 seems to be different. This hymn refers to the fighting of Sudās and the confederation of the ten kings, an internecine war which Sudās won with Indra's help. In this hymn Indra destroyed all their 'fixed/firm defences' (*dṛṃhitāṇi*) and their 7 *purs*, which here probably describe some kind of material structure. But even here some aspects are ambiguous. It is not as though Sudās attacked the 10 kings on their own native ground. This battle took place by the river Puruṣṇī where Sudās and his army was hard pressed, surrounded on all sides by the more numerous forces of the 10 kings (*RV* VII, 83, 6-8). What exactly were the *dṛṃhitāṇi* and *purs* destroyed by Indra? Surely the confederate foes could have had no forts/citadels, unless they were 'secure defensive positions'. But I am again inclined to think that the reference is to non-material protective means. The incident is most probably historical, but the number 7 has mystical associations and occurs in other cases.

There are some references to 'autumnal' *śāradī purs* but not many. In I 131,4 Indra overpowered unspecified "autumnal *purs*" known in former times. In I 174,2 he broke down the seven autumnal *purs*, shelter of tribes "with abusive speech *mṛdhrávāc*". Here these tribes could be human beings. In V*I* 20,10 Indra again destroys seven autumnal *purs*, shelter of Dāsas. Here too the Dāsas may be said to be human beings. These may be instances where the *purs* could belong to humans. However, the recurring mystical number 7 and the destruction by a god introduce strong elements of doubt and suggest again the supernatural. Moreover, I wonder if we are entitled to translate this adjective *śārada-* as 'autumnal'. It would be more correct, perhaps, in these cases to translate as 'ancient/old/enduring', or 'annual' in the sense of being renewed every year. These are ancient or annual (and to us) supernatural means of protection.

In connection with the supernatural aspect, most interesting is the curious reference to Śuṣṇa's 'mobile' *cariṣṇu pur*, VII 1,28, which Indra crushed with blows of his bolt. Clearly, a mobile *pur*, as shown earlier, is beyond all concepts of forts, cities, ramparts or whatever, in the physical world of the Vedic people. (Quite rightly Geldner connected it with magic.) Only a concept within what is usually regarded as the "mythological" super-natural sphere can make sense of Śuṣṇa's *cariṣṇu pur*. This at once illumines and suggests a similar sense for Agni's metallic *purs* and particularly the one which is *śatábhuji*, VII 15,14: obviously this fiery field with 100 folds or encirclements can only be magical or occult. One may argue that it is ordinary physical fire that destroys the *purs* of enemies but it is difficult to see how such a fire (or many fires) could repulse inimical armies. (Surely the enemies also could use fire as a weapon.) Fire would dispel the darkness of night or creatures of darkness like ghosts and fiends — or wild animals. Then, there are the prayers that Agni should guard people against distress and anxiety with his *purs* (I 58,8; VI 48,8), which would involve an esoteric psychological or spiritual type of protective means. The *śatábhuji pur* of the Maruts, I 166,8, is not very different, as was indicated earlier.

Just as interesting is the reference to *āmāsu pūrṣú paráḥ* wherein is protected the Offspring of-Waters *Apāṃ Napāt* II 35. W. O' Flaherty (1981: 105) translates this as "far away in fortresses of unbaked bricks" and one can't help but wonder where she found the "bricks", since the *RV* mentions them nowhere! I can only assume she follows Geldner (1951-7) who translates *In den rohen Burgen* 'in raw towns/forts', which means nothing, and who, to cover up the deficiency, adds in a note (6c) *nicht wie die gewönlichen Burgen aus gebrannten Ziegelsteinen gemacht* 'not like the usual Burgs made from baked bricks'(!) without telling us where in the *RV* we find 'usual Burgs made from baked bricks' — since there are no such constructions! Then O' Flaherty in an explanatory note mentions Agni, "safe... among enemies who do not control fire and so do not fire their bricks, or who (as the sun) is safe from his enemies... in his own 'natural' citadels not made of baked bricks, ie the clouds". The confusion here is almost unbelievable. Why and how exactly would Agni feel safe in such conditions and who are these "enemies"? Fire's biggest enemy is water; so fire dives and dwells in the waters protected within fortresses of unbaked bricks! Is this at all sensible? I don't think so. As for the sun, are not the clouds themselves his only traditional enemies? Neither unbaked-brick-fortresses (in water?!) nor physical enemies are involved here. *āma-* here (and perhaps elsewhere) should mean 'non-artificial, natural'. Thus Apāṃ Napāt in his own non-artificial, natural, divine condition with his own occult, defensive powers (*pūrṣu*) is protected against any malignity or niggardliness (*arāti*) and falsehood or unrighteousness (*anṛta*). If we had even one description of material forts/towers elsewhere in the *RV*, we could take *pū rṣu* here as being metaphorical towers (billows, perhaps).

Another interesting case is the *gómati púr* in *RV* VIII, 6,2. The phrase at first sight presents a difficulty since the adjective is usually translated as 'having kine'. But *go-* can mean 'wealth' by extension and certainly 'star, light'. So the phrase can just as plausibly be translated as 'protective-fold rich in light'. So this is ambiguous: it could be a pen with cows also but hardly a city.

There are many more instances of *pur* without any other distinctive feature: I 33,13; II 19,6; IV 16,4 and 26,3; VI 20,3; VII 19,5; etc. All the non-divine *purs* are destroyed by Indra mainly, to a much lesser extent by Agni (VI 16,39; VII 5,3; X 46,5) and even less by Soma (IX 48,2). In one case Indra is said to have shattered (*vṛṇak*) the *purs* of Cumuri, Dhuni, Pipru, Śambara and Śuṣṇa — all demonic figures. Elsewhere he destroys other demons' *purs*, Vala's (VI 18,5) and Namuci's and Vaṅgṛda's (I 53, 7-8). Often he uses his bolt (e.g. I 33,13) which is said to be his bull (I 131, 3) but in other cases he uses simply his *ojas* 'might/strength' (eg I 53,7) or his *māyā* 'magical power' (I 51,5). He uses this māyā in other exploits also as when he stops the overflowing waters of a river or puts to sleep 30.000 Dāsas (IV 30,12 and 21). This occult power is of course an attribute of other gods as well, chiefly of (Mitra and) Varuṇa; it is by means of this that Varuṇa, the chief *māyin* 'wielder of māyā', creates and regulates various phenomena in the world.

The power *māyā* is also an attribute of *asuras*, in the later sense of 'demons'. As we saw, in V 31, 7 Śuṣṇa is said to have *māyā*. Then, in X 138,3 Indra destroys the firm works (*dṛḷha*, here but elsewhere *pur*) of demon Pipru who is described as *māyin*; in I 117,3 the Aśvins offset the *māyā* of "the malignant Dasyu" and free Atri. I think that *māyā* and *purs* are connected in that the *purs* are created by gods and asuras with this power. Nowhere in the *RV* do we find one single statement that any *pur* (or *dṛḷha*) was destroyed by human beings just as we find no statement that any *pur* was constructed by human beings (though VI 45, 9 does refer to men's *dṛḷhāni*, which however are created by *māyā*, and asks Indra to destroy them). In VI 75,19 the poet says 'the holy power (or prayer) is my inmost armour' *bráhma várma mamāntaram*. The divine *pur* is like this inner *varma* which is *brahma*. In fact, in *Atharvaveda* V 8,6 we find the interesting verse"when [the enemies] attacked the divine strongholds (*-pur-*), the holy-power (*brahma*) made protective armours (*varmāṇi*)" (or "[Indra] made the brahma-power into armours"):[3] here we have all three elements. From this point of view the hymns refer perhaps to an age we have long forgotten and ceased to believe in, the age when divine beings mingled with human beings and helped them with divine *purs* against demonic beings and their *purs*. I say "perhaps" because it is difficult for us to accept such a situation as real, yet it does not seem impossible.

In that far distant age some men too are said to have used *māyā* or a manifestation of it as mental power, speech, knowledge, or the holy brahma-power. This spiritual power is used by Vasiṣṭha to help king Sudās defeat his enemies (*brahmaṇā* instr VII 33,3); by the same *brahmaṇā* Atri disclosed the sun (V 40, 6). Viśvāmitra stopped the flow of the rivers by the force of his speech *vacas* (III 33,8 and 10). The Ṛbhus, again, used 'power-of-mind' *manas* (IV 33,9) and 'true holy-spells' *satyamantra* (I 20,2-4) or *dhī* and *dhīti* 'thought, visionary power' (I 110,4; IV 36,2 and 4) to perform their miraculous deeds, like the rejuvenation of the Parents (IV 33,3) and so on; consequently they were given immortality in the mansion of the Sungod (I 110, 2-4). For almost 2000 years Christians, most learned people and scientists as well as uneducated folk, have accepted as true the miracles performed by the prophets of the Old Testament (Moses crossing the Red Sea, etc) and by the apostles and saints (rescuing and healing people). Yet when they meet similar miraculous works by the *ṛṣis* (= prophets and saints) in the Vedic hymns, they call them "mythology", as if divine powers are restricted only to Christianity. Moreover, the *ṛṣis'* attainment of a divine condition or immortality is, surely, no more "mythological" (unreal or incredible) than the prophets' and saints' attainment of a celestial or paradisal state basking in God's radiance. Most modern scholars think to solve the problem of this discrepancy by rejecting all miracles, religion and spirituality — which seems to be a much more general attitude now. But surely the miracle of life, birth and death, and the spirituality of mind, word and action will never cease, however materialist and drab or hedonistic ordinary life becomes.

Indeed, Dr J.E. Mack, a psychiatrist at Harvard University, writes: "It appears ever more likely that we exist in a multidimensional cosmos or multiverse... The cosmos... far from being an empty place of dead matter and energy appears to be filled with beings, creatures, spirits, intelligences, gods... that have through millennia been intimately involved with human existence" (1999: 169). Thus, there is no reason not to interpret *pur* as a supernatural defence.

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[3] For similar uses of *brahma* being *varma* see also *AV* VII 100, 1, VIII 2, 10, IX 2, 16; XVII 1, 27-28: all noted in Geldner (vol 34, p 178, n 19d)

Shanti Pappu and Sheila Mishra, *Man and Environment* XXXI(1): 126 [2006].
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Conference Report

International Symposium on Migration and Evolution of Early Humans in the Old World (Basie-Guangxi, China)

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This symposium was conducted by the Institute of Vertebrate Palaeontology and Palaeonthropology, Chinese Academy of Sciences, along with the Smithsonian Institution, USA, and sponsored by the National Nature Science Foundation, China. The Baise Government and Cultural Office at Guangzi, Zhuang Autonomous region, China hosted the conference at the historic town of Baise from December 5-9th 2005. The conference brought together scholars from all over the world to speak on topics ranging from the Lower Palaeolithic, biface industries and lithic technology, to environmental changes and palaeoanthropolgoical research. A total of 43 papers were presented, which covered recent research in East Asia, Africa, India, Israel and Europe. Papers from India were presented by S. Mishra, S.Pappu and R. Korisetter. S.Mishra and her colleagues presented papers on the Toba Tuff in India as a clue for the Acheulian puzzle, the hominid response to the catastrophic OTT at Bori and Morgaon in Western India, and on Early Acheulian assemblages in Western India. R.Korisettar presented on the early human colonization of South Asia; a geologic and geomorphic perspective. S.Pappu and colleagues presented on excavations at the Acheulian site of Attirampakkam.

A special focus was on discoveries in China, in particular in the Baise (Bose) basin site which was discovered 32 years ago. The Baise or Bose Basin site has been dated by tektites to 0.733 Ma in 1997, and subsequently ^{40}Ar/^{39}Ar dating placed these deposits at 0.803 Ma. The site comprises a lateritic terrace within which artefacts were found. The most important discovery was that of the use of Acheulian techniques in handaxe manufacture including shaping and refined flaking. The Chinese colleagues point to the fact that these handaxes are similar to those found elsewhere, and that recent work at the site of Fengshudao indicate the presence of cleavers and thinning techniques including even the Levallois.

The symposium enabled delegates to examine this interesting industry, which is termed as being Acheulian-like. Their studies imply that by the Mid-Pleistocene East Asian hominins could adjust their stone technology to local conditions including the ability to adapt to varied conditions and to produce what is termed Mode 2 assemblages.

The symposium organized an excellent field trip. Delegates were taken to the Fengshudao Locality, where Palaeolithic sites are found in mottled red clay along with tektites. This was followed by a visit to the Damei locality, where extensive excavations were undertaken. A visit to the Mohui cave site, Bubing basin, Tiandong county, was remarkable in terms of the fact the cave is one of the highest in the region, and revealed numerous fossil mammals, including Gigantopithecus and other hominoid species. Two hominoid teeth resembled that of the Chinese *Homo erectus*. Delegates also visited Terrace 4 at Tangmiaoling, Bubing Basin, and could examine the terrace features and surrounding karstic mountain topography.

The symposium was excellently conducted, with well-planned sessions, including visits to museums, viewing of lithic assemblages and time for discussion and interaction. The hospitality and warmth of the organizers and the volunteers were commendable, as also the care taken to see to the comfort of each and every delegate. Cultural programs introduced delegates to the rich heritage of this part of Southern China. The meticulous and high standards of research displayed by the Chinese scholars, their dedication and high work ethics, and immense pride displayed by local people and government officials in their earliest prehistoric heritage is something to be appreciated and emulated in India.

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Conference Report

Report on the International Symposium on "Early Human Habitation of Central, North and East Asia: Archaeological and Paleoecological Aspects', Denisova Cave, Russia

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Report on the International Symposium on "Early Human Habitation of Central, North and East Asia: Archaeological and Paleoecological Aspects' held between 16-25 August 2005 by the Institute of Archaeology and Ethnography, Siberian Branch of the Russian Academy of sciences at Denisova Cave Gorny Altai Region of Russia.

I was really privileged to be invited to participate in the symposium at Denisova cave. This week-long symposium combined discussion and presentations with visits to excavated archaeological sites in the Gorny Altai region around Denisova cave. The organization of the symposium was really superb. In the mornings we visited archaeological sites. After lunch we were shown collections from the sites and after that there was a discussion. Participants were from Korea, Japan, Israel, France, Germany, Austria, US, and Czechoslovakia. There were around 25 people from these countries and around 25 Russian participants, most of whom had contributed to the work being showcased in one way or another. I was the only Indian at the symposium and so I thought a report on the symposium would be of value to readers of this journal.

The area is at around latitude 51° N, and longitude 84 E; and is directly to the north of India. It is at the end of the Russian Steppe grasslands, which we saw in the 600 km road journey from Novosibrisk to Denisova. In August, the end of summer, the climate can be wet and miserable, but the symposium was blessed with a week of sunny weather, which was very pleasant.

The sites were of two types. Caves in the limestone, and open-air sites. The caves we saw were Denisova cave, Kaminnaya Cave, Okladnikov cave and Ust Kan cave. The other sites were open air sites of Anuii 1, 2 and 3, Ust Karakol, Karama, Kara Bom, and Tiumechin. We also saw the site of some Scythian burial mounds in Shiba. At the site of Tiumechin some Palaeolithic artefacts were earlier recovered by Ranov from a gravel deposit. The other open air sites were primary sites and very well preserved. They are on hill slopes. Archaeological horizons were preserved by deposition of sediments comprising mainly slope deposits or loess. Detailed sedimentological, palynological and soil studies were carried out at all sites. Radiocarbon dates were available from all the sites.

The key sequence is from the Annui valley, where our camp was. Here, the sites of Denisova cave, Annui 1, 2 and 3 and Ust Karokol were excavated. The cave has given a long sequence. The earliest presence of humans in the cave is in layer 22 with an early Middle Palaeolithic technology with some hint at Late Acheulian. The most abundant archaeological material is from the period of around 60-25 kyr correlating to the Oxygen isotope stage 3 with the transition from Middle to Upper Palaeolithic. In the Upper part of the Pleistocene Denisova cave sequence a number of ornaments have been found including beads of bone and ostrich eggshell, worked bone and perforated stone. The open- air sites of Annui 1 and 2 are at the foot of Denisova cave and contribute to the understanding of the cave but did not have good preservation of either bones or artefacts. However, Annui 3 upstream of Denisova cave in the present camp area and Ust Karakol, 2 km upstream at a tributary junction yielded very good archaeological and palaeoenvironmental evidence. These open-air sites all have fluvial gravels at the base. This gravel has an estimated age of around 200 kyr. The gravel is a few metres above the Annui stream and shows that the valley has deepened after the deposition of the gravel by a few metres. The sedimentary sequence shows alternation of fine silt deposited as loess with rubble from the surrounding hillslopes. The loess also shows horizons of soil formation.

Archaeological material occurs in distinct layers and includes well-preserved fauna. Good correlation between Annui 3 and Ust Karakol sections shows that the sedimentation reflects changing environmental conditions at the site. Integration of the archaeological, sedimentalogical, palynological and faunal data shows that Denisova cave was most probably only occupied by humans in the winter and by hyenas in the summer. In the early part of the sequence it was probably a bear den. The open-air sites were probably summer occupation sites. The archaeological methodology of the team was very impressive with true interdisciplinary teamwork. Wet sieving of cave sediments was carried out by using a pulley system to directly take the cave sediments from the excavation to the nearby stream.

The caves of Kaminnaya Cave, Okladnikov cave and Ust Kan cave were in adjacent valleys to the Annui valley. The other key site was Kara Bom which is an open air site in the shelter of a rock outcrop. It is one of the key sites as it has yielded one of the earliest dates for the Upper Palaeolithic anywhere at around 42 kyr, implying that the Middle to Upper Palaeolithic transition occurred earlier in this region than in Europe. Despite this early date Okladnikov cave shows a late occurrence a of Mousterian assemblage, normally associated with Neanderthals.

The site of Karama was also impressive. This is also in the Annui valley but on a higher surface. Huge trenches have been dug here. The sediments are considered to date to the early Middle Pleistocene. Infact this is quite convincing as the characters of the sediments show intense weathering. Local bedrock is limestone, but this has been weathered so that the gravels at Karama have only granite, a non-local rock type. The silts and clays also show rubification and clay formation. I, therefore, was fairly convinced by the dating of the Karama site. However the artefacts recovered were very meagre. Although a few of the artefacts do appear genuine there does not appear to be any regular cultural horizon as there is in the later sites. The claim of very early occupation at Karama cannot be dismissed but it still does not show well-established resident human population at that time.

The main discussion at the symposium therefore, was on the transition of the Middle Palaeolithic to the Upper Palaeolithic. I was quite amazed that archaeologists from the Middle East and Europe could readily recognize the similarities of sites in their countries with the Altai sites. The artefacts from the sites were eagerly studied and there was intense discussion of the "Middle Palaeolithic" versus "Upper Palaeolithic" technologies. I must confess that none of this discussion was relevant to anything I had seen in India. Neither the Middle Palaeolithic nor the Upper Palaeolithic assemblage were at all like any assemblage from India. On the other hand, what struck me was the great similarities between the Upper and Middle Palaeolithic and Middle Palaeolithic! Both were dominated by production of large points, made on blades. The difference between the Upper Palaeolithic and Middle Palaeolithic technology was only in how the blades were struck from the core. This relatively minor difference however most probably signals a species replacement event.

When I was at Denisova cave last August, I was impressed by the work done by the Russians and ashamed of my former ignorance of their work. I enjoyed the interaction of so many archaeologists from around the world, but I wondered to some extent why I had come. The Indian Palaeolithic did not seem to have any parallels with anything I had seen. However, in the last year, I find that, precisely this was a very significant realization. I now firmly believe that the European terminology of Lower, Middle and Upper Palaeolithic adopted by us in India is inappropriate at best and misleading at worst. I have thought this for may years, but was reluctant to struggle to change it, but now I think serious misunderstandings of the Indian Palaeolithic are created by using this terminology. This is not the place to further discuss the Indian Palaeolithic, but my visit to Denisova cave, which is after all, is on the border of "not India" has convinced me that the Middle to Upper Palaeolithic transition was different, and, most probably, earlier in India than in Central Asia. This is also strongly suggested by the recent studies of the genetics of Indians.

My visit to Denisova cave therefore was truly a lifetime experience. I observed the culture of "toasts" which accompany ceremonial dinners in which the toastmaster proposes toast after toast and in which the person toasted has to give a return toast. This created a festive but slightly formal atmosphere, inspite of the alcohol consumed in the toasts. In Novosibrisk I was impressed with the Institute of Archaeology and Ethnography, which comprises a large building and employs over 50 archaeologists! Also impressive is the journal published by the Insititute, *Archaeology Ethnology and Anthropology of Eurasia* the precious "baby" of academician A.P. Derevianko. We were given the publications related to the sites in the Altai, most of whose site reports were published. Russian publications all had not only English but also French summaries.

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Book Review

Kanungo, Alok Kumar (Ed.). 2005. *Gurudakshina: Facets of Indian Archaeology — Essays Presented to V.N. Misra.* Oxford: BAR International Series 1433.

Unlike other festschrifts, this volume on Professor V.N. Misra has turned out to be his valuable academic biography. Joglekar has added a very useful annotated bibliography of Misra's main works. This gives a bird's eye view of the colossal contributions made by Misra in the field of Indian archaeology. As regards the historiographical study of Misra's contributions to the Indian archaeology, the most perceptive and valuable essay has been contributed by K.K. Basa. In my view this perceptive essay will have a historical value.

Misra had to grow under the towering banyan tree of his mentor, H.D. Sankalia. Sankalia wrote innumerable articles and books covering history, epigraphy, ethnography, protohistory and prehistory. He was the most prolific scholar of the last century in historical sciences, but Misra by sheer dint of his brilliance and hard work emerges as a very worthy successor of Sankalia. Basa has done a great job of situating Misra's contributions in Indian archaeology.

Kanungo has tried to portray the human qualities of Misra. Despite his brilliance and academic stature, Misra never suffered from any false pride. He was always accessible to scholars and students alike. Nor did he ever suffer from rancour, vindictiveness and hatred, which are the bane of scholars in responsible positions. He helped many of his students monetarily; some he even brought up like his own children at his home.

It is heartening to note that the editor has maintained the quality of papers by getting them evaluated by well known scholars. This has ensured their quality. That he could get all the Ph.D. students of Misra to contribute to this important volume owes itself both to the high regard Misra's students have for him as also the indefatigable efforts of his worthy student and editor of the volume, A.K. Kanungo.

Let's have a brief glimpse of the contributions of Misra's students that reflect not only the quality, but also the range of interests of their supervisor, Misra himself.

Alam has reported his work based on metrical analyses of the stone tool assemblages found during the excavations at Bhimbetka in Madhya Pradesh. He deals in detail with the typological, technological, functional and stylistic variability of the stone artefacts. Jacob and Munaf discuss the topography and settlement pattern of the Tirupati valley of Andhra Pradesh. They encompass the stone assemblages from the Palaeolithic to the Mesolithic periods of the Tirupati valley, with special emphasis on raw material and subsistence strategies by comparing the Palaeolithic man with the Yenadi hunter gatherers who live in the area even today. Basak reports on her study of the prehistoric land use patterns in the context of the microlithic sites of the Tarafeni valley in West Bengal. Kumar Akhilesh discusses the Upper Palaeolithic 'Damin' assemblages of the Bansloi river basin. In his analyses Kumar studies the artefacts in their stratigraphic context, the inter-site variably of lithic technology and prehistoric land use patterns.

It is interesting to note that for the first time Katy Dalal in her paper on the Harappan Ceramics of the Ghaggar valley brings out the presence of the Hakra Ware. It is a unique occurrence to find her son Kurush Dalal's paper on early historic non-ceramic assemblages discovered at Balathal, in the same volume. Thus Misra by now has guided two generations of his students.

I am happy to note that Kharakwal has also given an article on the archaeology of the Kumaun Region. This is a neglected area but Misra encouraged Kharakwal to do a Ph.D. on his explorations of this area. I am sure it would prove a pioneering work on the prehistory of this difficult terrain. Following the footsteps of his teacher, Kharakwal presents a stimulating multidisciplinary account of his explorations.

It is typical of Misra to give importance to his younger colleagues; as a result most of his finds from Balathal have been studied by his students and colleagues. Anup Mishra has produced a detailed analysis of the Chalcolithic ceramics found at Balathal; Kurush Dalal has studied the non-ceramic material from the early historic levels of Balathal; Abhijit Dandeker reports on the ceramics and their technology covering the Early Historic period of Balathal. Earlier, Shafiqul Alam and Yashodhar Mathpal did their Ph.D.s on the Palaeolithic assemblages and rock art of Bhimbetka, excavated by Misra in the 1970s.

Reddy in his essay covers a large number of Mesolithic, Neolithic and Megalithic sites of the Palavoy region of Andhra Pradesh. He also reports the excavated finds of the ash mound of Palavoy. Hoque in his paper discusses the settlement patterns during the prehistoric and protohistoric periods in their ecological context covering the middle and lower Ganga valley. Sunil Gupta tries to reconstruct the various aspects of maritime trade between India and the Roman Empire. He presents his work in a historiographical framework. Rahman reconstructs the early historic and medieval period settlement pattern in the Bogra district of Bangladesh.

In his wide ranging review, Thomas tries to reconstruct the Mesolithic and Chalcolithic subsistence patterns of western India. His was the first study in India which covered the faunal remains at the site of Bagor in Rajasthan. He has also presented a review of the archaeozoological research carried out at the Deccan College.

Shahida Ansari tries to reconstruct the subsistence pattern during the Mesolithic-Chalcolithic period in the south-central Ganga valley. She combines archaeological data collected by the Allahabad University with her own ethnographic study of the *Kols, Musahars* and *Mallahs* of the region.

Tama Panda Roy has tried to delineate the socio-cultural evolution in the coastal districts of Puri and Ganjam and in the inland district of Sambhalpur of Orissa, synthesising geographical, archaeological, ethnographical and linguistic data.

After this brief survey of the essays in the Volume on Misra, we would like to highlight the main points of K.K Basa's perceptive essay, "Situating V.N. Misra in Indian Archaeology: A Historiographical Account", which will have a lasting place in the history of Indian archaeology.

Situating V.N. Misra in Indian Archaeology

Highlighting the results of the Deccan College-PRL Team's work in Rajasthan, Basa says, "Reconstruction of past environment and its relationship with prehistory has been the focus of some important interdisciplinary researches in the last two decades — in Rajasthan (Misra 1987a, 1987b), Rajasthan and Gujarat (Allchin *et al.* 1978), Kashmir valley (Agrawal 1992) and the Son valley, Madhya Pradesh (Sharma and Clark 1983)... Seen against this background, Misra's interdisciplinary work for reconstructing the climatic history of Rajasthan is a continuum. There are four aspects of Misra's ecological approaches. First, as has been stated, ecological background was an important aspect of Misra's prehistoric research. Second, for reconstructing the past environment, he depended on multidisciplinary research, such as geomorphology, sedimentology, palaeontology, archaeozoology and archaeobotany. Third, Misra emphasized adaptation to local environment in his study of prehistoric cultures. Last but not the least, despite his emphasis on ecology, Misra, unlike Dhavalikar, did not resort to what may be called the ecological determinism. Incidentally, Dhavalikar has used environment as the determining factor for the rise and fall of the Chalcolithic culture at Inamgaon... For Misra, however, ecology constrains but does not determine cultures..."

Basa also tries to focus on Misra's extensive contributions to Indian Protohistory, especially his work in Balathal. Basa then tries to situate Misra in the context of ethnoarchaeological research in India. There are six aspects of Misra's ethnoarchaeological research. First, as regards methods, he did fieldwork among various ethnic groups, in particular hunter-gatherers, resorting to anthropological methods of participant observation and questionnaire. He also followed the archival methods by studying colonial writings on the hunter-gatherers of the Ganga plain. Second, he regarded the contemporary hunter-gatherers in India as descendents of prehistoric communities and in that sense he followed the direct historical approach in ethnoarchaeology. Third, he also drew our attention to several ethnographic examples of hafting of microliths in suitable shafts from various parts of the world thus emphasizing the importance of ethnographic studies in the functional interpretation of prehistoric tools. In that sense, he followed the general comparative approach in ethnoarchaeology. Fourth, he also discussed the process of incorporation of tribal societies into caste society with the help of archaeological and ethnographic data. Fifth, Misra not only discussed the hunter-gatherer communities in the hilly region which is usually done by ethnoarchaeologists, but also laid stress on their survival even in the plains by his study in the Ganga plains. Sixth, the persistence of traditional communities is, Misra argued, because of both ecological adaptation as well as historical factors.

Regarding the theoretical aspects of Misra' work, Basa says, "... V.N. Misra has been eclectic as far as theory was concerned. For example, he considered both diffusion and evolution as factors of culture change. As far as New or Processual Archaeology is concerned his perception was closer to Sankalia than to Malik or Paddayya. Three features characterize Misra's archaeological research with regard to New Archaeology. First, he emphasized adaptation to the environment by prehistoric man. Second, he conducted ethnographic research to provide flesh to the dry bones of archaeological data. Third, he also used quantitative methods in his prehistoric studies."

Basa concludes that Misra contributed significantly to prehistory, protohistory, and ethnoarchaeology and rock art studies. Like Sankalia, fieldwork remained a hallmark of his career and like Grahame Clark he applied an ecological approach to prehistory in general and to the Mesolithic in particular.

Theoretically eclectic, he followed ecological, ethnoarchaeological and quantitative approaches as far as the anthropological tradition of Indian archaeology is concerned. However, he has not ignored history, and in that sense, he has been conscious of both the anthropological and historical traditions of Indian archaeology.

Thus, to Basa, Misra appears to be a secular nationalist; a fact with which most of us would agree. Basa terms it a modest attempt to situate V.N. Misra in Indian archaeology in a historiographical manner. In my view however this profound evaluation of Misra's work will remain a valuable historical document, the importance of which cannot be underestimated.

The book covers a wide range of topics relating to the archaeology of different regions of India and the contributions are based on original field and laboratory data. It is a must for every library and for all scholars interested in South Asian archaeology.

Towards the end of this review, I would like to add a personal note. Misra and I started our academic career roughly at the same time. We worked together to create and sustain the Indian Society for Prehistoric and Quaternary Studies and its bulletin, *Man and Environment*. We also worked in joint projects in Rajasthan for almost a decade. Though we worked on several projects together, we never had any personality clashes, despite our ideological and personal differences, mainly because of his amiable nature. Whenever we went to Pune, which was often, we were his guests at his home, where he was always liberal with food and drink.

Besides his command over archaeology and anthropology, Misra always impressed us with his knowledge of several languages. He knows Sanskrit, French, German and Russian and of course he is also fluent in Marathi. Though he had heavy duties of administration and academic projects, they never cramped his lifestyle. He always looked relaxed and at ease. He would never hurry his routine of reading several newspapers or for that matter, his leisurely bath.

Above all he is a great human being, an affectionate and steadfast friend who can be fully trusted.

Indian archaeology looks forward to being enriched by his research in the coming years.

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Book Review

Reflection of Ethno-Science: Study on the Abujh Maria by Samira Dasgupta and Amitabha Sarkar. 2005. 107 pages. Price: Not mentioned. New Delhi: Mittal Publications

In this small volume Samira Dasgupta and Amitabha Sarkar have given an account of the culture and society of the Maria Gonds of the Abujh Mar (meaning unknown Hills) region of the Bastar district of Chhattisgarh State in Central India. Even though the district was divided into three smaller units of Kanker, Dantewara and Bastar in 1996-97, the authors prefer to use the name of the undivided entity. The district is inhabited almost entirely by tribal communities which comprise Gond (Maria and Muria), Bhatra, Halba, Dhurwa and Dorla. In recent decades many non-tribal people have immigrated into the district, particularly as skilled and non-skilled employees in the large iron ore project at Bailadila and as traders.

The Abujh Mar region, located in the northwestern part of the district, covers an area of 3900 km^2 and has a population of 19250 persons (according to 1981 census) which is living in 236 villages. The Abujh Mar or Hill Marias are one of the most primitive tribes of India. Their habitat consists of hills and dense forests. The region has no roads and is virtually isolated from the surrounding country. The only place which is connected by road to the outside world is the Orcha village which is the headquarter of an administrative Block. Here a weekly market (*hat*) is held and the Marias come to sell the forest produce and buy items of their requirements like utensils, salt and cloth, mostly through barter. This brings them into contact with people of other communities. Their language is Gondi which belongs to the Dravidian family but most of them are able to speak a local dialect of Hindi.

The data reported in the book was collected during several field-trips between 1992 and 1999 mainly in Orcha and Ader villages of the Chota Dongar Pargana of the Abujh Mar though field trips were also made to several other villages.

The authors have used the term ethno-science for the subject matter of the book, and have defined it in several ways at different places. Some examples: "The study of aboriginal population's causal explanation of various natural phenomena at their niche, without the aid of the sophisticated scientific gadget, has been referred as ethno-science" (p. 1). "When a fisherman identifies a particular spot in a sea for his fishing, he considers chiefly the colour of water, where there is probability of getting fish and it is his cognition, which he has acquired over generation and this sort of wisdom, is ethno-science... It deals with systematic experience and observation on the relationship between various natural phenomena."(p. 3). "Ethno-science is the study of classification systems used by societies; in this study one has to rely more on the insiders cognition than on outsiders interpretation. Above all the idea of ethno-science is to project a picture which is ethnographically neutral; it needs not represent the so-called etic view or the analyst's view or the emic view, or informants view. When we study a society or culture it is a collective reality or collective entity. Through application of methods of ethno-science, a researcher should be in a position to project the collective view of the concern society or culture from a value neutral position" (pp. 3-4). According to the reviewer's understanding of the authors' definitions, in the present context, the term means the Marias' perception of their natural environment, their knowledge of the plant and animal resources of their environment, the technology they use to exploit these resources for subsistence, housing, health care, etc., their social organization, religious beliefs and practices, and their world view. The book gives short accounts of these aspects of the Abujh Maria society and culture.

The economy of the Abujh Marias is very intimately connected with the forest. It consists primarily of shifting cultivation and to a very small extent of hunting. Hunting is confined to small animals like hare, field rat and several species of birds. Collecting is an important part of the economy and is carried by both the sexes. While men collect wood, bamboo, grass, resin and honey, women collect tubers, roots, fruits, flowers, seeds, leaves, and leafy vegetables for consumption as food for their own families as well as for sale. A variety of wild fruits are available in the forest. Mahua flower is collected on a large scale for food as well as for making liquor. Bamboo, whole or split, is used for housing, and its splits, in conjunction with siyari leaves, are used for making baskets, rain hats, rain coats and containers for storing grain, etc. Wood is used for house construction and for shafts and handles of household implements and weapons. The authors have provided a list of the items which are collected.

Besides for hunting and collecting, the forest plays a very vital role in shifting cultivation. The land used for cultivation is classified into several types on the basis of its location — on hill slope, hill top, or plain; size, soil, and the kind of crops grown. The land is communally owned. It is allotted to individual families by the village chief on the basis of their requirement. The real owner of the land is the tribal deity, *pen* who may be a male or a female and who is one of the original tribal ancestors. The land of a particular *pen* is again divided into clans or *kattas*. A plot of land is cultivated for two to four years and once its fertility is exhausted, the family moves to another plot and after about twenty years it comes back to the original plot. By this time the forest has regenerated and the land has regained its original fertility.

The Abujh Marias are very conscious of the conservation of their land and forest. They do not fell the tree from the bottom but about a metre above it to allow the stump to regenerate. Also they do not cut fruit trees. There are also sacred groves in which economically important tree species are conserved. Further, the fruit of any tree is not consumed until the forest deity has been propitiated by worship and offering. Abujh Marias have a deep fear of offending their deities and ancestral spirits and refrain from any act which might do so.

The *pens* are celestial beings who have spouses and children. Every village and sometimes every clan has its *pen*. Table 4.2 gives a list of the *pens* and *kattas* under their control. The social organization of the Abujh Marias is of the Phratry type. There are a number of clans. They are related to one another either by consanguineal or affinal ties. The clans having former relationship are *dadabhai* or agnates to each other whereas clans having the latter kind of relationship are *saga* or *akomama* to each other. Marriage can take place only in *akomama* clans. The Abujh Marias practise cross-cousin, junior levirate and junior sororate type of marriages. These marriage types are very well reflected in their kinship terminology. Bride price has to be invariably paid, and where the family of the bridegroom is unable to pay it, the bridegroom works for the family of the bride for some years. Divorce is allowed and both divorcees and widows can remarry.

In the religion of the Abujh Marias their ancestors or *pen* deities and *Bhum* or Mother Earth are the most important. There are separate priests for the worship of these deities. Both *pen* deities and *Bhum* have their abode in sacred groves where no damage can be done to a tree, not even a twig can be broken. The Abujh Marias believe that their material possessions — the land, harvest, and everything else is a blessing from their ancestors and other deities and therefore they do everything to keep them happy.

The Abujh Marias have a very thorough knowledge of the plants and herbs of their environment and their medical properties. A comprehensive list of the medical plants and herbs, the diseases for the cure of which they can be used, and the methods of their use has been given by the authors in table 6.1. The Abujh Marias use these plants for the treatment of various diseases. The *leske* (medicine man) and *sirha* (sorcerer) play important roles in the diagnosis and treatment of diseases.

The dead are buried and a menhir is erected to perpetuate their memory, except in the case of those who died an unnatural death.

The authors have given an account of the myths and legends of the Abujh Marias regarding the creation of the universe, sun, moon and stars, mountains and rivers their concept of time and season, the criteria for identifying them, way of counting days, the signs for identifying good and bad omens, interpretation of natural phenomena like the sound of a word or falling of a meteor, meaning of different kinds of clouds, etc. The omens play an important role in their decision making regarding important events like marriage negotiation, starting of shifting cultivation, etc. At the end of the book the authors have summarized their observations.

The book, which is probably the first comprehensive study of the Abujh Marias, contains very useful information about their society and culture and their perception about various natural and social phenomena, their deep knowledge of the resources of their environment and the techniques of exploiting them for the satisfaction of their needs, and their economic, social and religious life. The authors have painstakingly collected a large body of data and presented it in a systematic form. The presentation of quantitative data in tabular form makes the information easily comprehensible and adds to the value of the book. The authors deserve to be congratulated for accomplishing this fine piece of work.

One important omission, however, is the treatment of the Maria music, song, dance and folk tales. Also, It would have been useful if the authors had given a map showing the location of the villages where they carried out their fieldwork, exact duration of the field work in each village, and information about the principal informants. This would have been useful for subsequent field workers.

The reviewer has to point out with regret that one serious flaw in the book is the language. There are a number of repetitions, for example, regarding the location and environment of Abujh Mar and shifting cultivation; numerous mistakes of grammar, spelling, punctuation marks, and incomplete sentences. In many cases there is no coordination between the subject and the verb. Far too many paragraphs and sentences begin with a pronoun, particularly 'They", without a noun preceding them. There seems to have been no proof reading of the text. A few examples may be given. Words in bold represent the mistakes.

Sustainable use of local resources **are** done; the traditional knowledge **have**; hills and **its** forest (p. 19); Abujhmarh hills **is; deers (p. 21)**; all **these** knowledge (pp.

22, 37); This grass has some economic value and they sell **those (p. 25); cattles are** (P. 27); deity **do not** respond (p. 29); This purifies the object on **what** the water is sprinkled (p. 31); restriction **help,** their custom **help** them; **beers** (for bears) (p. 33); two to three **production** (p. 34); Wood felled **are;** various types of small **of** *kosra*; all the **refuses** (p. 39); **an** outsiders (p. 41); preferred by most **by** them; *awa* is the term **of** mother (p. 63); the months of rainy season are the preferred months for **their** marriage (P. 68); **weekly market** is held **once in a week** (p. 69); she extends her **hands** of co-operation, household **works, works** of the field (p. 70); her **progenies,** the place is full **with** vegetation, if any **tree** falls, **these** trees ...(p. 77). In chapter 5 the heading at the top of the page is printed as **Refelction** of ...**Relife** ....in place of Reflection of... in Belief. Even the captions to illustrations have mistakes, like Abujh Maria family in **reluctant** (relaxed ?) mood, mother and child **with** affection, Segregation hut of **women** during **her** cycle.

These and many more mistakes cannot be due to the carelessness of the printer alone, and, if they are, an errata should have been provided. It is a pity that a valuable contribution in the preparation of which so much hard work has been put in should be marred by indifferent printing. I am sure the book will soon need a reprint, and I hope the authors will take care to remove all these mistakes which, even though not detracting from the academic worth of the book, are certainly an irritant while reading it.

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Book Review

Pratapgarh Janapad ka Puratattva (in Hindi) by Ram Naresh Pal 2005. Allahabad: Swabha Prakashan. Pages 223. Price Rs. 300/-

This book is a revised version of Ram Naresh Pal's doctoral thesis entitled "Archaeology of Pratapgarh District". The area of this research (Pratapgarh District in Uttar Pradesh) is not unknown to students of Indian archaeology since famous archaeological sites such as Sarai Nahar Rai, Mahadaha and Damdama are located here.

The book contains six chapters, a list of references and an index. It has several maps, illustrations and photographs. The first chapter gives us an overview of the physical features, drainage pattern, ecology, flora and fauna, and tribal communities of the district. In the second chapter the author narrates the history of the district as known from various archaeological and literary sources. We learn that the name Pratapgarh itself is not very old. It can be traced to Raja Pratap Bahadur Singh of the 17th century. Before that this region, was at times, included in Kosala and Ayodhya (Awadh). The author has been careful in utilising literary records, specially the Puranic ones. Yet he recognizes the need to cautiously look for threads of historical reality in such early narratives. However, the archaeology of the district leads us to a story of several thousands of years. The Epipalaeolithic culture is the earliest in this region followed by the Mesolithic culture that flourished along the horse-shoe shaped lakes.

The archaeological record of the district is well known due to pioneering efforts of archaeologists of the Allahabad University since the 1960s; working under the leadership of Late the Prof. G.R. Sharma. The third chapter provides a detailed account of investigations conducted in the study area, most of which are wellknown to us through various publications of the Allahabad University. The fourth chapter provides the results of archaeological explorations carried out by the author. During his survey Ram Naresh Pal found a total of 91 sites spread in four tehsils — Kunda (71), Lalganj Azara (9), Sadar (6) and Patti (5). These are pre-NBP to early medieval in age. A few of these sites were known earlier. The author has done a thorough investigation at these sites to highlight their relevance to the subject. All sites are described in detail in this chapter.

The last two chapters are devoted to a synthesis of the archaeological data. The author finds that like other regions of the Middle Ganga Valley, there has been a continuity of settlements in Pratapgarh District from the Epipalaeolithic to the Modern period. He also concludes that during the Early Historic period more areas were settled due to increasing population pressure.

Although most students of Indian archaeology are aware of the subject matter of this book, it contains new information on archaeological sites in the Middle Ganga Valley. Therefore, this book is very useful to all those interested in the history and archaeology of the Ganga Basin.

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Announcement: The new ISPQS Website http://www.ispqs.org

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At the annual conference held in December 2005 at Bangalore, the Executive Committee of the Indian Society for Prehistoric and Quaternary Studies (ISPQS) decided that the society should have its presence on the internet to reach as wide an audience as possible. The task of creating the website was entrusted to Arun Sinha and V. Selvakumar.

The website design was based on the requirements supplied by various members of the Executive Committee. The address (URL) of the website is: **www.ispqs.org**. It currently consists of the following pages (sections), described below.

About us

This page has a description of the history and philosophy of the society. It also has a complete list of the current office bearers and the past chairpersons and general secretaries of the society. This page also has a complete list of the award winners of the H.D. Sankalia award for young archaeologists.

Membership

A downloadable MS-Word formatted application form for joining the society is now available online.

Awards

Every year the society presents awards for excellence, which are described here.

Man and Environment

This is a link to a site containing the complete table of contents of the society's journal *Man and Environment*, since its inception in 1977. This section was created and is maintained by Arun Sinha.

Publications

A full list of the occasional monographs published by the society is available on this page.

Universities

This page contains a partial list of universities offering courses in Archaeology and Prehistory. They are listed here along with their addresses and websites, if they have any.

Grants and Fellowships

Several organizations offer grants and fellowships to students and scholars in archaeology. They are listed here along with their addresses and other relevant contact details.

Jobs

This page is designed to advertise job openings in Archaeology and Prehistory. If you know of any job openings, please click on the "Contact Us" button, and send us an email.

Organizations for Dating Samples

Names, addresses and websites of organizations that undertake chronometric dating are given here.

Related Websites

Links to related websites.

Calendar

Information about upcoming events, such as conferences and seminars, including the annual conference of the ISPQS.

Future plans include adding a page on "Breaking News". This is your website. Please visit www.ispqs.org, and help to make it an attractive and useful resource for the archaeological community.

S.N. Rajaguru *et al.*, *Man and Environment* XXXI(1): 147-150 [2006].
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Obituary

Gudrun Corvinus (1932-2006)

Gudrun Corvinus was born in the city of Stettin, Poland in 1932. From a very young age, she was fascinated by the world of nature and was drawn to study geology, palaeontology and archaeology. She graduated from the University of Bonn and subsequently moved to the University of Tübingen where she could pursue her interests in geology, palaeontology and prehistory. Her doctoral dissertation was on 'Jurassic Ammonites in France', with additional courses in prehistory. Her thesis was examined by the eminent scholar, Prof. F.E. Zeuner, whose contributions to Indian archaeology are well known.

In 1961 following her marriage, Gudrun moved to India, and was associated with the Deccan College, Pune. Shortly after this, she shifted to Chandigarh, where she received a CSIR fellowship and worked under Prof. M.R. Sahni on the project 'Early Man in India'. In 1964, she surveyed the entire Pravara River on foot, accompanied by two porters and sleeping in villages along the way. It was then that she discovered Chirki, one of the most important prehistoric sites in Peninsular India. Prof. H.D. Sankalia of the Deccan College supported her project to excavate Chirki. She also received a grant from the Wenner Gren Foundation of Anthropological Research, as well as a research scholarship and jeep for fieldwork from the German Research Council. The excavation of Chirki (1967-1969) marked a new phase in Indian prehistory. This phenomenal work involved meticulous excavation and recording methods and sophisticated lithic analysis. The report which was published later, proved to be one of the few well published in-depth reports on an Acheulian site in India. Despite numerous publications and two monographs, she was modest and reticent about her work and it received due recognition on an international level only in recent years. The nature of an Indian Early Acheulian industry, description of the Kombewa technique in India, handedness in tool use, and many other issues in lithic technology were discussed for the first time in the Indian context. The monograph also presented the first detailed study of cleavers in Indian prehistory.

Following excavations at Chirki, she worked at Olduvai Gorge in East Africa with the Leakeys. In 1973 Gudrun joined the International Afar Expedition team which was to work in the Afar desert in Ethiopia, Africa. After the sensational discovery of the 3 million year old Australopithecine fossil 'Lucy', Gudrun discovered the oldest human artefacts dating to 2.6 million years located within silt exposures below a datable volcanic ash deposit. In 1975, due to the revolution in Ethiopia the expedition was called off and she worked for a year in Paris with the French team members. Despite devastating experiences with some of the North American team members who claimed credit for her work, she continued to pursue her interests and did not give up.

In 1976 she was called by the Anglo-American and De Beers Company to work as Senior Geologist in the

Diamond Mines of SW Africa (Namibia). Her job was to date the diamond deposits along the desert coast and to search for human artefacts and animal fossils, which could help date the diamond deposits. She worked in the Namibian desert on the Skeleton Coast of southwest Africa. While exploring the numerous deep pits and trenches, the result of extensive mining activities along the coast and the river, she came across a very rich fossiliferous deposit resting on bedrock, about 40 m below the surface. This was a remarkable discovery as the fossils turned out to be about 18 million years old. In the upper layers of the diamond deposits she discovered many Early Stone Age artefacts and thus could assign a date to the deposits as ranging between 18 million to about 1 million years. She worked up to 1980 in this region, and then was transferred to the South African Museum at Cape Town where she analysed the data for a period of two years. The fossils were initially housed at the South African Museum, where they were carefully preserved and documented by Gudrun with other staff members. Later, after Namibia's independence in 1989, they were moved to the Geological Survey and museum in Windhoek. Once again, at the inauguration of this exhibition, she suffered a severe disappointment, when due credit was not given to her, nor was she ever mentioned as the original discoverer of these fossils.

After this project was completed, she worked as a tour guide in South Africa in order to earn money. She then wished to move back to South Asia, this time to work on the Siwaliks of Nepal. The reason for moving back to the Siwaliks, was put forward in an interview conducted by S.Ghate. Gudrun stated that, "The Siwalik sediments in the Himalaya were formed between 13 and 1 million years. Hence I thought this was the right place, after Africa, to maybe find the human story of least last the 1.5 million years. The African experience was an enormous influence to go out to new and virgin areas". This project was supported by the German Research Council, and in 1984, she began work on the 'The Geo-Archaeological Nepal Project'.

She had chosen an area where a new road was being cut through the Siwaliks and all the rocks of a tilted monocline of 5000 m thickness were freshly exposed. Of the utmost importance was the fact that they turned out to be full of fossils of extinct animals and plants. Thus started a 12 year long project, renewed every year by the German Research Council.

For the most part Gudrun worked entirely alone, her knowledge of geology, palaeontology and prehistory being phenomenal. However, she also received assistance from scholars at the Wadia Institute of Himalayan Geology and the Birbal Sahni Institute of Palaeobotany in Lucknow, as well as from Tübingen University. This study helped her reconstruct the geology of the last 13 million years along with changing environments. As she said, "From a tropical rainforest environment in the beginning, the vegetation changed to a subtropical and deciduous one and even to a dry grassland type in the last 2 million years, when the Himalayas were much more glaciated than today and the fauna, which we found in the various periods, adapted to this change". The Surai Khola section of the Siwaliks of Nepal, is now a standard and model section for scholars and students of geology in this region.

As regards prehistory, Gudrun stated, "Yes, with all the experience of India and Africa behind me, I had developed a sort of sixth sense in finding prehistoric sites of the Stone Age people. I was convinced that such people also lived in Nepal, even in the hilly Siwaliks, having migrated from the Indian plains". With persistent surveys over many hundreds of kilometers on foot in the hills and Dun valleys, Gudrun discovered more than a hundred prehistoric sites. Most tools were embedded in the lake and river sediments in the valley, and exposed by erosion. Practically nothing known of the prehistory of Nepal, and no Acheulian sites had ever been found until Gudrun began her work here. She discovered Acheulian artefacts at Gadari, in the Dang valley, at the base of the Dun valley fill as also in tilted sediments at Satpati.

"My most wonderful moment was when I found, after 7 years of survey, the first Acheulian handaxe at the base of the whole alluvial sediment. Here it was exposed by the erosion. I found more tools at the same site. This was an exciting find, because it showed me that even the earliest people of the Stone Age had penetrated into the Himalayas, certainly from India, and that the heritage of Nepal's population goes back to the Early Palaeolithic, like in India, some half a million years or even more".

She discovered the Middle Palaeolithic site of Arjun 3, in the Dang valley, documented the Late Pleistocene flake and pebble tool industry which she called the 'Brakuti' industry. She also found microlithic site at Lamahi. In Eastern Nepal she worked at the Pattu site, a Holocene Neolithic site and she tried very hard to get the site dated by luminescence methods. The artefacts from this site had definite affinities with the Hoabinhian culture of mainland Southeast Asia, found in Thailand and Vietnam. This indicated that links must have been established to SE Asia via the forested mountain belt. To solve this puzzle she visited Thailand, Burma and Vietnam, and studied collections there. She had also discovered a few sites in Tibet, where she never thought of finding Stone Age cultures. The monumental monograph which is currently in press, is the result of this tireless and meticulous research which was her trademark.

During her long stay in Nepal she often visited Deccan College in Pune. She said, "I come to Deccan College to refresh myself. I talk to scholars there, mostly to my old colleagues from years ago, discussing ideas with them and feeling the response and interest extended from them, reading the journals and books that I don't have in Nepal. Talking with people like Dr. Rajaguru, on Quaternary geology or about prehistory with Dr. Sheila Mishra, who shows new directions to your thoughts, or different explanations of the problems that you have not thought of yourself'.

On a personal level, all those who met Gudrun were struck by her unflagging curiosity and desire to learn. She loved traveling, not by plane, but in trains. She traveled all over India, through Eastern and Southern Africa, and in Southeast Asia, wherever trains were available. She also traveled from India via Iran and Turkey to Germany. Her most adventurous journey was in 1984 when China opened up. She traveled all alone, without speaking a word of Chinese, from Hong Kong, overland through China, Mongolia, and Russia, back to Germany. "It was the most hazardous experience. I don't want to do it again" she admitted, "but I also didn't want to miss it".

She was modest and humble, an excellent field worker with a commendable hold on the subjects of geology, palaeontology and prehistory. Her love of music and reading, Indian culture and traditions, her adventurous spirit and generous nature will be remembered by all her friends and colleagues. Her love of animals and great concern for the environment struck all who knew her well. Above all, she never gave up. Her brutal murder in January 2006, in her flat in Pune, has deprived us of a true scholar, a good friend and a unique human being. She lives on in wonderful memories her friends and colleagues have for her, and in her monumental academic contributions.

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I. P.K. Thomas, hereby declare that the particulars given above are true to the best of my knowledge and belief.

P.K. Thomas

Special Issue on the Conservation and Management of India's Cultural Heritage

It is a well-known fact that India has an immensely rich and varied cultural heritage. It has a time depth of over a million years, and has developed in varied environments like the very cold Himalayan hills and valleys, densely forested regions of the northeast, Western and Eastern Ghats, cold and rocky desert of Ladakh and hot and sandy desert of Thar in western Rajasthan, fertile alluvial plains of the Indus, Ganga, Brahmaputra, Narmada, Godavari, Krishna, Kaveri, and other river basins, eastern coastal and Malabar plains, and vast wooded plateaux of peninsular India. Each and every ecological zone has developed its distinctive culture which is manifested in food and techniques of its preparation and consumption, material objects, including technology, of ever-day use, art and architecture. dress, ornaments, language, social customs, religious beliefs and practices, literature, painting, music, dance folk tales, etc.

This immense and rich cultural heritage has evolved over a very long period of time. The story of its evolution is preserved in thousands of archaeological sites, monuments, material objects, manuscripts, books, paintings, etc. Unfortunately, introduction of modern technology, rapid industrialization and urbanization, virtually unchecked population growth, and growing pollution are taking a heavy toll of this heritage. Our archaeological sites are being destroyed due to expansion of settlements, conversion into farming land, and implementation of various developmental schemes like building of roads, railways, airports, canals, and industries, etc. Sites, monuments, sculptures, manuscripts, books, paintings, etc. are decaying and disappearing due to the action of natural agencies, official neglect, public apathy, vandalism, unplanned tourism related structures, clandestine trade in cultural materials, etc.

Central and State governments, municipal bodies, NGOs and some enlightened individuals are contributing to the conservation and preservation of the heritage but it is obvious that that is not enough, and much more effort is needed to arrest the rapid decay and loss of this heritage. A focused policy involving government organizations, research institutes and universities, NGO's and the immediate local state-holders is urgently required.

We believe that every one of our readers has witnessed this process of decay and loss, and some of you have given thought to how this can be checked and stopped.

We would like you to contribute your knowledge, experience and practical suggestions for a special volume of the *Man and Environment* that we would like to bring out in 2007. Please write to us your reaction to this idea, and let us know if you can contribute a paper, and also suggest us names (along with addresses) of others who can. We want articles based on accurate factual information and practical suggestions and not jargon-heavy theory.

We look forward to hearing from you.

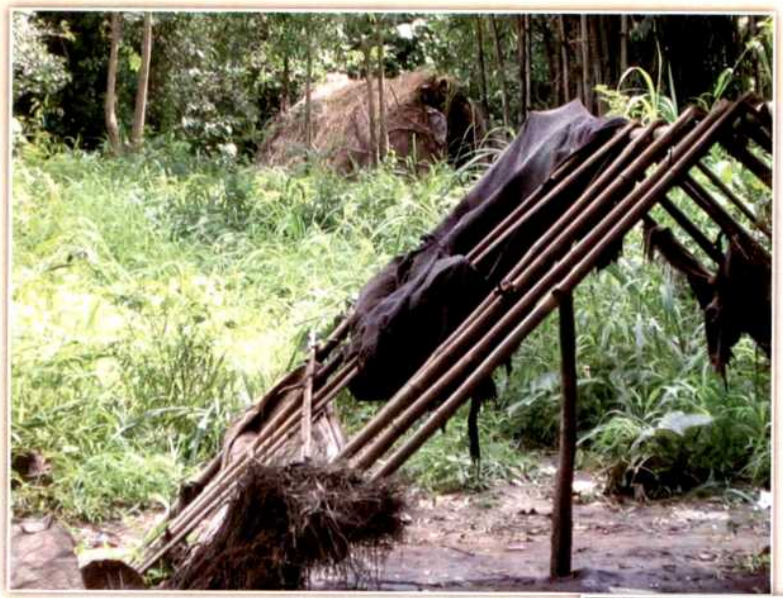
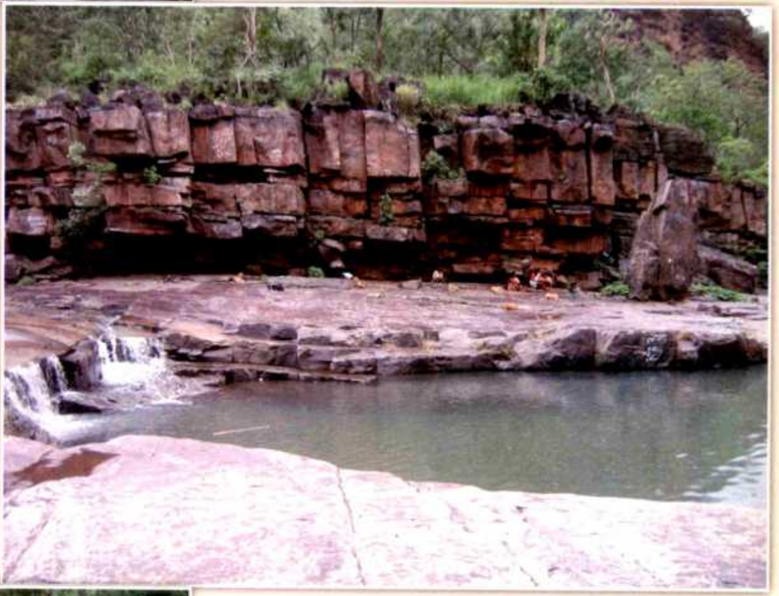


Fig. 9: Type site II a (abandoned) Temporary dwelling — work camp (Potarazu Penta)

Fig. 12: Type site III: Transient camp at Bheemunu Kollam (rock shelter site) 1. double hearth (for cooking) 2. Three stone hearth (for warming)



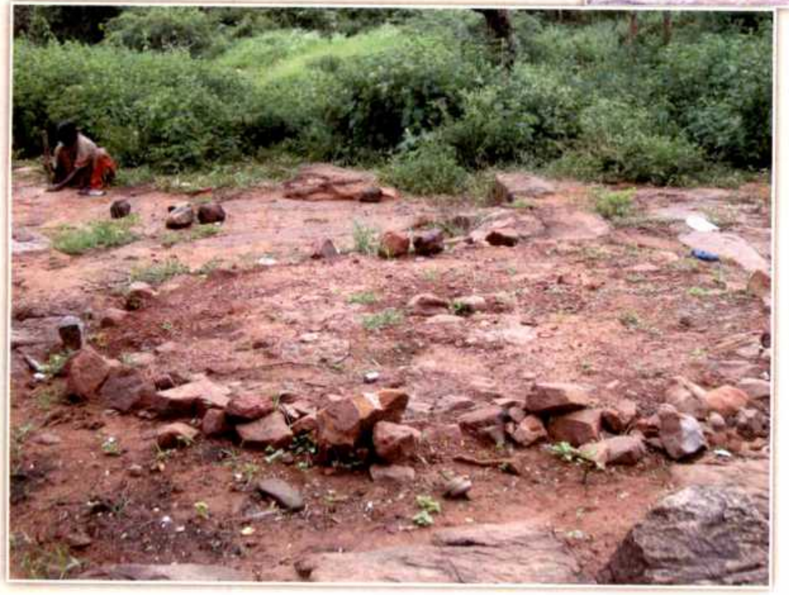


Fig. 15: Circular stone arrangement of abandoned dwelling hut (Banda terrain)

L. Anjana Reddy, *Man and Environment* XXXI(1): 1-18 [2006].
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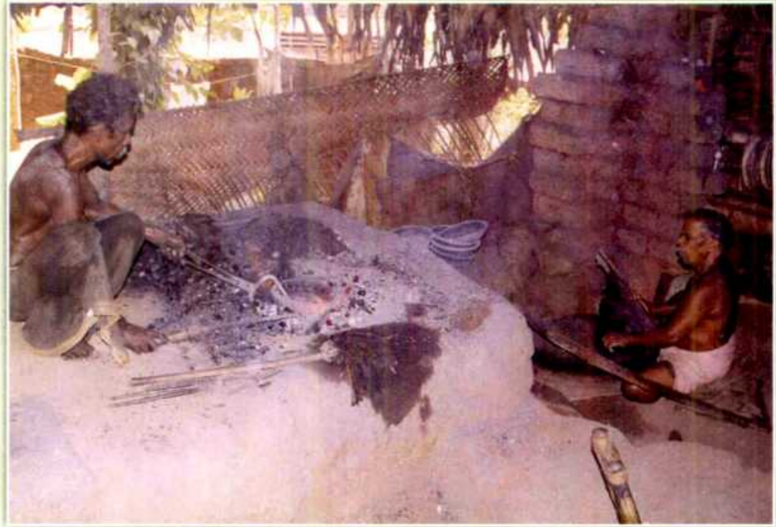

Fig. 5: Annealing of high-tin bronze ingot, Payangadi, Kerala

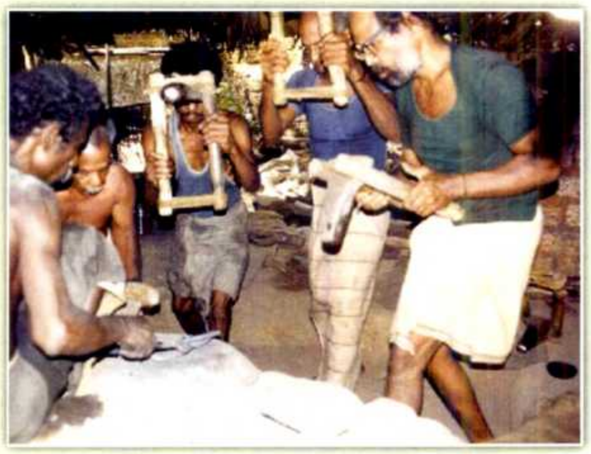

Fig. 6: Forging of high-tin bronze ingot to bowl, Payangadi, Kerala

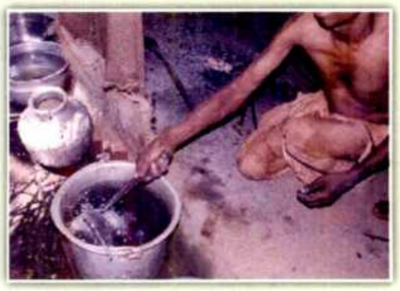

Fig. 7: Quenching of high-tin bronze bowl, Payangadi, Kerala

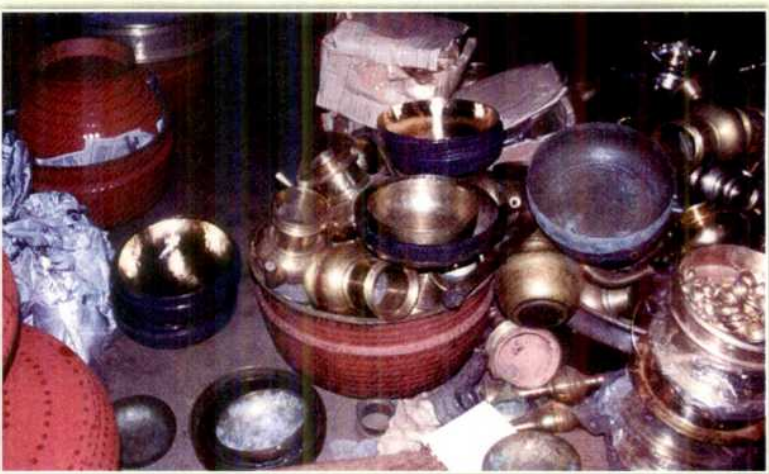

Fig. 8: High-tin bronze bowls with inner polish, Payangadi, Kerala

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Man and Environment

Journal of the Indian Society for Prehistoric and Quaternary Studies

Editor: V.N. Misra
Joint Editors: P.P. Joglekar, Savita Ghate, Shanti Pappu, B.C. Deotare, K. Krishnan

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Editorial

This issue of *Man and Environment*, like our previous issues, offers rich and varied fare covering the topics from the late Pleistocene-Holocene interface through Neolithic, Chalcolithic, Harappan, Early Iron Age and Medieval studies to metallurgy, ethnoarchaeology, and archaeozoology.

D.A. Sant and his colleagues examine the flood plain record of rivers in Gujarat and its implications for the southwest monsoon during the Last Glacial. E.L. Harvey and her co-workers have attempted a reconstruction of early agriculture in Orissa on the basis of archaeobotanical evidence from Sisupalgarh and other field observations.

Extensive and intensive research during more than eight decades in the Saraswati basin in northwest India has provided voluminous evidence of a long and continuous history of human occupation from the Pre-Early Harappan period to the present-day. Using the site distribution data, L.S. Rao has attempted a reconstruction of the settlement pattern of the predecessors of the Early Harappan people in Fatehabad district (Haryana) which lies in the core of this basin. Like other Harappan urban settlements, Rakhigarhi, also in Haryana, was supported by a string of small settlements whose study is important for understanding the socio-economy of the mother settlement. Tejas Garge reports on the archaeological remains of one such settlement, namely, Lohari Ragho, from surface explorations.

Excavations at the Chalcolithic site of Balathal near Udaipur in Rajasthan during 1994-2000 produced five human skeletons, all buried in the habitation or ash deposit within the settlement. A morphometric study of these skeletons by Gwen Robbins and her associates is ready but could not be included in the present issue because of shortage of space. It will appear in the June 2007 issue. However, we are publishing an account of the pathological markers on these skeletons by the same authors.

S.B. Ota and Prakash Sahu describe *Palas* leaf impressions on the burial pots from the Chalcolithic site of Utawad in M.P., and the information they provide on pottery manufacturing technique. Debasri Das Gupta reports on her catchment analysis of Gilund, the largest known site of the Ahar culture.

Sharada Srinivasan, a specialist in early metallurgy, reports her ethnoarchaeological study of the manufacture of megalithic high-tin bronzes. The research comprised in this paper was presented at the Society's annual conference at Bangalore in 2004, and was one of the two papers, which won the Malti Nagar Ethnoarchaeology Award. K.K. Bhan's paper, also belonging to the field of ethnoarchaeology, provides an understanding of the techniques involved in the manufacture of medieval glazed pottery from Lashkarshah in Gujarat. Sudarsana Choudhury and Tushar Jash report their study of the underground storage system in ancient India. P.K. Thomas and his associates present an analysis of the faunal material collected by V. Shobha from Early Historic sites in Kaarnataka.

We have noted that there is not a single paper on Palaeolithic-Mesolithic studies in this issue. Does it indicate a declining interest in these periods? If so, it is a matter for concern because cultural developments during these periods provide the foundation for later prehistory. We hope that readers will share our concern and take steps to arrest this trend. India is exceptionally rich in Palaeolithic-Mesolithic remains and offers immense scope for research.

We would like to remind our readers about the announcement in the previous issue for bringing out a special issue on the conservation and management of India's cultural heritage, and we look forward to receiving good-quality papers on this theme.

The publication of this Journal has been financially supported by the Indian Council of Historical Research (ICHR) and the Archaeological Survey of India (ASI). The responsibility for the facts stated, opinions expressed, or conclusions reached is entirely that of the contributors of the articles. The ICHR and ASI accept no responsibility for them.

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Cover: Stone crushers (small) from Lashkarshah

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Megalithic High-tin Bronzes: Ethnoarchaeological and Archaeometallurgical Insights on Manufacture and Possible Artistic and Musical Significance*

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Abstract

The megaliths of peninsular and southern India represent one of the enigmatic aspects of Indian archaeology, with few burial-cum-habitation sites having been uncovered near cairns or burials. Archaeometallurgical investigations by the author on a range of thin vessel fragments from a range of megalithic sites such as Adichanallur and the Nilgiris in Tamil Nadu, and Mahurjhari in the Vidarbha region of the early to mid 1st millennium B.C. point to the use of binary copper tin alloys with a higher content of tin. The sites in the Nilgiris and at Adichanallur in particular, showed well developed use of wrought hammered and quenched high tin beta bronze (with around 23% tin) and rank amongst the finest earliest examples of this craft from anywhere in the world with extraordinary rim thinness of up to 0.2 mm. Although the provenance of some of the fine Nilgiri bowls was previously thought to be of foreign origin, original ethnoarchaeological and archaeometallurgical studies conducted by the author have established, partly in previous papers (Srinivasan 1994; Srinivasan and Glover 1995; Srinivasan and Glover 1997) and partly here, that these could well have been of indigenous manufacture. This is seen from comparisons with surviving rare crafts for making high-tin bronzes in Kerala which are amongst the very few well reported studies of such craft survivals in the world. Evidence of slag from co-smelting copper and tin ores was found by the author from Kalyadi in Karnataka, which suggests that there may have been minor local tin resources in South India which could have been exploited (Srinivasan 1997a). This paper explores some further aspects of the technology and related archaeological issues, and explores significance of this intriguing material culture. It is pointed out from ethnographic comparisons with high-tin bronze bowl making traditions in Kerala, that the rings, the knob-base, the polish and fluted shapes seen in the Nilgiri and Adichanallur bowls could have been part of a local tradition. Apart from artistic significance it is also pointed out that since the traditional high-tin bronze bowls from Kerala are known as *talavettu* or musical vessels, it is also possible that the megalithic high-tin bronze bowls could have had musical significance. Quenched high-tin beta bronze alloy (23% tin) is still used to make cymbals in parts of northern Kerala. A proclivity for musical materials in south Indian prehistory may perhaps be postulated given that Boivin (2004) has argued that rocks from Neolithic Kupgal had percussive functions. Thus the paper well demonstrates the usefulness of ethnoarchaeological approaches in archaeological and archaeometallurgical studies.

Introduction

Is generally understood that there was something of a hiatus and even regression in terms of the development of copper-bronze metallurgy between the Indus Valley (3rd millennium B.C.) and the subsequent Chalcolithic and megalithic cultures of the second and first millennium B.C. in terms of range or quantity of finds. Even so, this paper puts together results of investigations on some bronze vessels from Iron Age sites and megalithic contexts of southern India such as the Nilgiri megaliths and cairns and the Adichanallur Iron Age burials, to show that these reflect sophisticated bronze working practices with the use of a specialised alloy known as wrought and quenched high-tin bronze alloy (hot forged and quenched binary copper-tin alloys of about 23% tin resulting in the predominant retention of martensitic beta phase). These not only rank amongst the earliest such alloys known in the world but also suggest that bronze metallurgy at the time was more advanced than previously suspected.

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* This paper was presented for the Malti Nagar Ethnoarchaeology Award at Bangalore and was selected for the award. The second paper by Anjana Reddy selected for this award, was published in the first issue of this volume.

It was previously thought that the skilled technology of high-tin beta bronze working was developed in Southeast Asia or China and then spread to India, while its use is scarcely reported outside Asia. However studies by the author of surviving techniques for making wrought and quenched beta bronze bowls and high-tin delta bronze mirrors in parts of Kerala, together with analyses of finds from South Indian megaliths and Iron Age burials from other parts of India of the early to late first millennium B.C. suggest that the technique might have had indigenous origins (Srinivasan 1994, 1997a; Srinivasan and Glover 1995, 1997). Vessels from Adichanallur and the Nilgiris represent some of the finest examples of wrought and forged high-tin bronze vessels found with very fine rims of down to 0.2 mm thickness indicating extensive forging followed by quenching and fine decorations. If this is indeed so, it also remains a possibility that this technique could have in turn also spread to tin-rich southeast Asia, especially Thailand where well documented finds of high-tin bronzes are also known at Ban Don Ta Phet by the 4th century B.C. where the technique seems to have flourished to skilled heights (Rajpitak and Seeley 1979; Bennett and Glover 1992).

Investigations on Megalithic High-tin Bronzes

Generally, cast binary copper-tin alloys with over 15% were not much in vogue in antiquity as they become brittle due to the presence of the delta phase component. However investigations by the author from prehistoric, medieval and modern south Indian examples indicate the continued use of specialised binary high-tin beta bronzes with 22-5% tin to make artefacts such as vessels, coins and musical instruments (Srinivasan 1994; 1997b).

Metallurgical investigations by the author on very thin vessels from South Indian burials and megaliths of Adichanallur (Figs. 1-2) and the Nilgiris (Figs. 3-4) (*c.* 1000-500 B.C.) (Srinivasan 1994; Srinivasan and Glover 1995) indicated that these were wrought and quenched high-tin beta bronzes, i.e. copper-tin alloys with 23-25% tin (analyses reported in Table 1). These were fabricated by extensively hammering out such an alloy between 586-798 °C when plastic beta intermetallic compound (Cu_5Sn) of equilibrium composition (22.9% tin) forms, followed by quenching, resulting in the retention of a needle-like beta phase (Figs. 2, 4) which prevents the formation of a brittle delta phase. In contrast, low-tin bronzes have limited workability.

Despite the analyses reported in Breeks (1873: 63) of a few vessels from the Nilgiri cairns being of 20-25% tin-bronze, it was believed that these artefacts were imported (Leshnik 1974: 156) and the possibilities of there being a local continuing tradition were never explored. The author was the first to have identified such a continuing tradition of high-tin beta bronze vessel making from any part of the

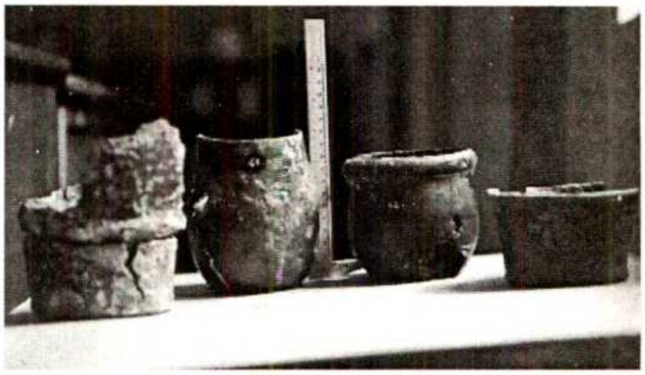

Fig. 1: Jug (acc. no. 61) from Iron Age Burials of Adichanallur, Tamil Nadu (c. 800 B.C.), Government Museum, Chennai, analysed by the author and found to be of wrought and quenched high-tin bronze (22.9% tin)

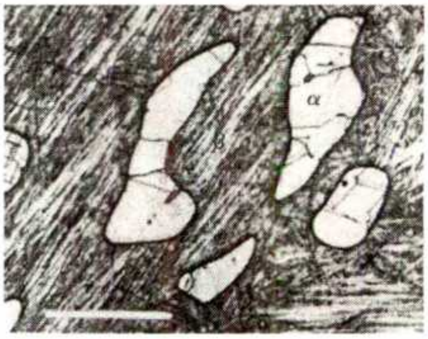

Fig. 2: Micro-structure of the above jug of high-tin bronze (22.9% tin) from Adichanallur showing elongated needles of beta martensite and some islands of twinned alpha phase indicating it was hot forged and quenched resulting in retention of beta phase.

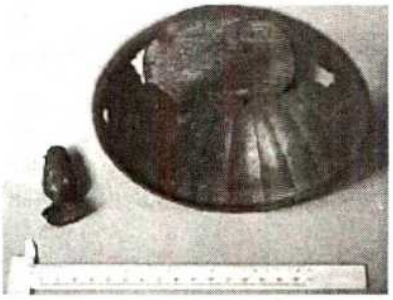

Fig. 3: Fluted high-tin wrought and quenched beta bronze bowl with 23.9% tin, Nilgiri cairns (c. 1000-500 B.C.), Tamil Nadu, Government Museum, Chennai. An incense burner is also seen.

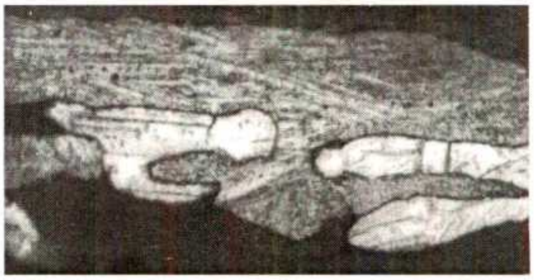

Fig. 4: Micro-structure of the above high-tin wrought and quenched beta bronze bowl (23.9% tin) from the Nilgiris, Tamil Nadu (400X)

world, in the village of Payangadi in Kerala** and to have correlated these with micro-structures in vessels from the South Indian megaliths of Adichanallur and the Nilgiris (Srinivasan 1994; Srinivasan and Glover 1995). At Payangadi, high-tin bronze vessels were made by extensively hammering out (in cycles of annealing and hot forging) an alloy close to a composition of 23% C around 600 °C in the temperature range of formation of the plastic beta intermetallic compound, followed by quenching, resulting in the retention of needle-like beta phase (Figs. 5-7, please refer inside front cover). At the workshop, the author also found that the resultant alloy has musical properties and acquires a very bright golden polish which would explain its significance in antiquity (Fig. 8, please refer inside front cover). Figure 9 is a finished and polished wrought and quenched high-tin bronze bowl made at Payangadi of 22.5% tin with analysis reported in Table 1.

Prior to these studies, non-Indian sources had been suggested for the bowls from the Nilgiri megaliths to be located in West Asia (Leshnik 1974: 156) or East Asia (Rajpitak and Seeley 1979). However, it now seems likely that they were made in ancient Kerala since they closely resemble the wrought and quenched high-tin beta bronze bowls from Payanagadi. The resemblance is not only metallurgically, but also stylistically, in the use of concentric rings in the centre of the bowls made in 1991 by using a hand-turned lathe. This is consistent with local lore where the Todas, the original inhabitants of the Nilgiris, claimed that such vessels came from Kerala (personal communication with Evam Piljian of the Toda community). The author is currently also investigating vessels from megaliths in Kerala. Allchin and Allchin (1982) also postulate indigenous developments for the south Indian megaliths.

The author is currently investigating a few vessel fragments and artefacts from the Vidarbha megaliths of Maharashtra, where some sites are dated to the 8th *c.* B.C. The micro-structure of a finial from Boregaon shows it to be a cast and quenched beta bronze with 21% tin, while some wrought and quenched beta bronze bowls from Mahurjhari have 18-19% tin showing some martensitic quenched beta phase amidst alpha phase islands. However, in none of these high-tin bronze vessels from the Vidarbha megaliths was the composition range of formation of predominant beta phase of around 23% tin fully reached. They were not extensively worked or hot forged as the high-tin bronze vessels from the Iron Age megaliths of the Nilgiris and Adichanallur which show a stage of true mastery of the plasticity of the martensitic beta phase. Paramasivan (1941) published a photograph of a micro-structure of a bowl from Adichanallur which is comparable to a quenched high-tin bronze. Two samples excavated from the Indus Valley site of Mohenjo-daro (*c.* 2500 B.C.) also had analysed of 22% tin-bronze (Mackay 1938: 480), although micro-structural data is not available. These finds may predate those hitherto known from elsewhere in antiquity. This may suggest a departure from well entrenched ideas (e.g. Craddock *et al.* 1989: 23) that the Indian subcontinent would have more likely received diffusionist bronze technologies or traded bronze from tin-rich Asia, especially Southeast Asia.

Links with Present-day High-tin Beta Bronze Bowl Making in Kerala

In 1991, the author documented the making of wrought and quenched high-tin beta bronze vessels, gongs, cymbals and ladles in Payangadi. Microstructural investigations on two bowls from Payangadi and Trichur confirmed that the largest concave bowls, of 25 cm diameter, 8 cm depth and 1.4 mm rim thickness (Fig. 9), were made out of a flat circular ingot of 22.5% tin of a diameter of only 15 cm, and 1.5 cm thick. This was done by forging in cycles of hammering and annealing followed by quenching between 600-700 °C, all in the a+b phase field (Figs. 5-8, please refer inside front cover). The inner surface of quenched bowls are often polished bright golden, to contrast with the exterior quenched skin (Fig. 9). My late grandmother, a householder interviewed in 1991, said that the *talavettu* (i.e. musical vessels due to the tonality of the b-martensitic alloy) were preferred to brass for storing food, very likely due to the non-toxicity of a high tin content and the alloy's corrosion resistance. She added that food was not heated in such vessels, probably due to the formation of an embrittling lower temperature phase upon cooling. Moreover, the inner part of the wrought bowls was decorated using hand-turned lathes creating concentric rings very similar to the megalithic bowls from the Nilgiris and Adichanallur. Thus, it was possible to extrapolate how the south Indian megalithic high-tin bronzes could represent a long standing local metallurgical tradition.

At the workshop of Kammalar Bhaskaran in Payangadi, an ingot was cast with an alloy of 10 kg of copper with 2.75 kg of vellium or tin, into a flat ingot with around 500 g extra tin added to compensate oxidation losses. The composition of the cast ingot has approximate 23% tin. The plasticity of the bronze with around 23% tin was exploited by heating it in the beta temperature range of about 600 °C following which it was placed on a stone anvil. Four craftsmen took turns in powerfully hitting it with wedge shaped iron hammers fitted into a wooden frame known as *cherangulam*. After about two cycles of hammering by high intensity blows, the ingot again was annealed in the beta temperature range. Further cycles of hammering followed till the flat ingot took a progressively concave shape. This continued all afternoon, until the bowl

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** First reported in 1991 this activity has now sadly ceased to take place at this village.

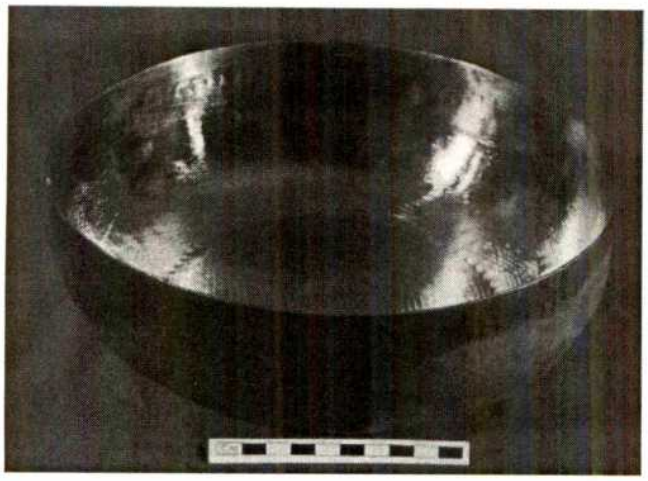

Fig. 9: Recent high-tin bronze vessel, Payangadi, Kerala made in 1991

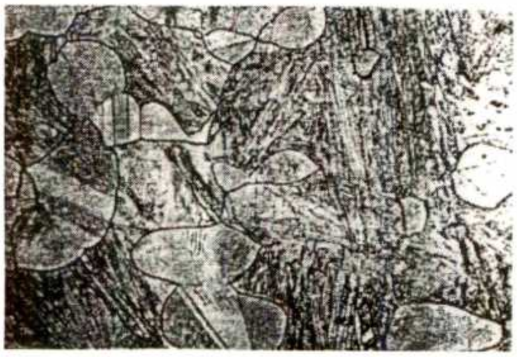

Fig. 10: Micro-structure of the above high-tin bronze vessel made in 1991, in Payangadi, Kerala of wrought and quenched high-tin bronze (22.5% tin)

attained a remarkable concave shape with an ingot of 15 cm diameter and 1-1.5 cm thick being transformed into a thin concave bowl of diameter 25 cm, 8 cm height and rim thickness of only 1.5 mm (Fig. 9). This indicates that the degree of plastic deformation was more than twice that of the ingot, which is remarkable for bronze. In a collaborative study done by the author and Oleg Sherby it was found that high-tin bronze is quasi-superplastic.

Finall, the bowl was annealed on a bed of charcoal and rapidly quenched in a tank of water which would have frozen the meta-stable martensitic beta phase. According to the craftsmen, this prevented breakage of the vessels. A rounded wooden mallet was also used in the stage of final rounding and hammering of the bowl. The blackened surface of the as-quenched bowl was scraped with shears and files to remove the fire skin and expose the bright golden lustre of beta bronze. The micro-structure of this bowl shows a typical structure of quenched beta high-tin bronze with martensitic beta and an alpha plus beta structure (22.5% tin) (Fig. 10). This would explain why this alloy was in vogue in ancient times. It is remarkable that in one Iron Age example from Adichanallur, and a few from the Nilgiri megaliths, there is no dark patination rich in tin oxides, which is often found, and the original bright golden lustre still comes through. Some Vishnukundin coins were also struck of this alloy, apparently for this reason. Another interesting aspect of the high-tin bronze bowl-making process observed in Payangadi was the striking similarities with megalithic vessels from the Nilgiris in the shape and the use of circular rings for decoration. The latter were made by mounting the vessel on a lathe with clamps on a wall and hand-turning it, using a set of files like a compass (Figs. 11-12). Thus, it was possible to see the legacy of the Nilgiri bowls in these processes in Kerala (Fig. 12).

In 1998 when the author and I. Glover re-visited Kerala these craftsmen from Payangadi had given up their trade, however, another set of craftsmen were at work making rather smaller high-tin bronze vessels in Paridur in Kerala. Here, to speed up the process a set of four ingots were piled on one another and forged (Fig. 6, please refer inside front cover) and then final forging done on each before quenching.

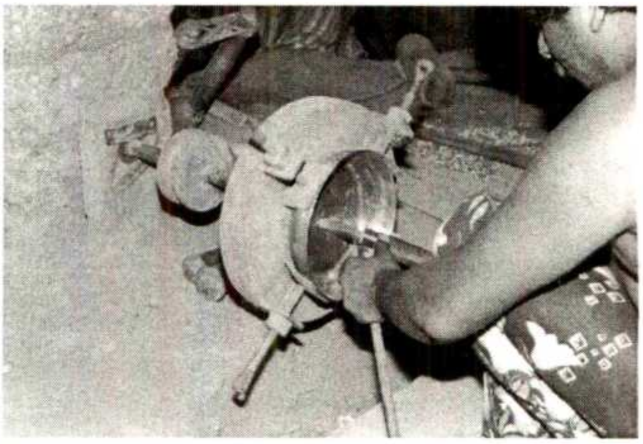

Fig. 11: Making inner rings as decoration on polished high-tin bronze bown in Payangadi, Kerala using a hand-turned lathe

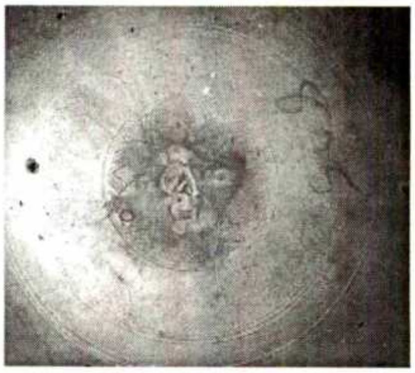

Fig. 12: Inner rings in vessel from Nilgiri megaliths, Government Museum, Chennai

At a crafts fair in Bangalore, the author also documented craftsmen from Kantilo in Orissa, who made smaller and shallower vessels which could be identified as being of high-tin bronze from the tonality, lustre and existence of one blackened face from quenching. The manufacture process described by them also tallied. Here, as in some older vessels from Kerala, the edge of the rim is given a flared effect or sometimes a fluted effect, which also recalls the Nilgiri vessels which are nevertheless much thinner and subjected to greater hot forging. Mukherjee (1987: 89-91) also described the making of 'wrought bell metal" which perhaps referred to high-tin bronze. The author also visited a workshop in Anjar where small cups were made of high-tin bronze, although these were mostly as-cast to shape and only lightly forged before quenching. Flat plates with raised rims were also made by them known as *Kasher thala*.

Casting and Forging of Musical Cymbals of High-tin Beta bronze in Kerala

During a subsequent field trip to Kerala in 1998, in Mallapuram district, it was found that traditional cymbals are still made using wrought and quenched beta high-tin bronze. Here the cymbals are not as extremely hot-forged as the bowls. The main aim seems to have been to quench the 23% tin beta bronze alloy so as to get the martensitic transformation of the metastable beta phase which has significant musical properties of high tonality. However, the cymbals are roughly cast to an approximate concave shape by the open casting process in a sand mould. Thereafter they are finessed to a fine concave shape of about 10 cm diameter and 1 cm thickness after annealing the alloy and hot forging them in the temperature range of formation of the plastic beta phase. A hole in the centre is made by hot hammering with a long chisel to enable the two hand cymbals to be strung together for playing. The final polishing to bring out the bright golden lustre is done by filing following by hand polishing with polishing powders (Fig. 13-15). The cymbals used for traditional Bharata Natyam performance and other dances known as *tala* or *nattuvangam*. Cymbals such as these are depicted, for example, in a bronze Nataraja from Melaperumbulam (*c*. 12th century A.D.) and *tala* finds mention in Chola inscriptions. Flat gongs are also made of high-tin bronze. Given the tonality of high-tin bronze, it is possible that the musical effects of the high-tin bronze alloys were known in antiquity.

Re-examining the Milieu of Megalithic High-tin Bronzes

The emergence of urbanism in southern India and the factors leading to it are perhaps less well understood. The process of urbanisation from Neolithic or Megalithic stages seems to have come about later by about the 3rd century

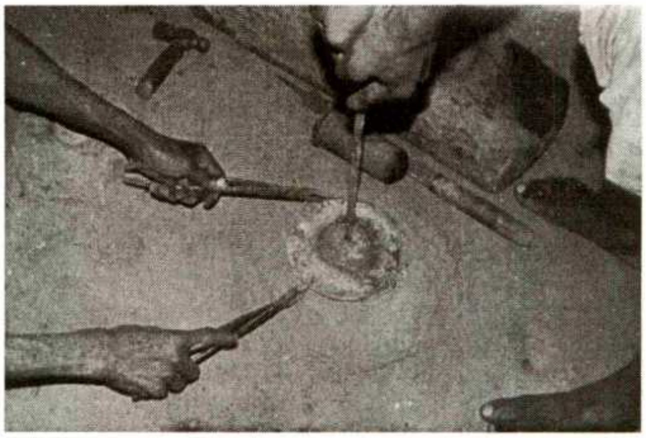

Fig. 13: Making of high-tin bronze cymbals, Mallapuram, Kerala: hammering of central hole of high-tin beta bronze cymbal when heated to temperatures of formation of plastic beta phase (c. 650 °C–750 °C)

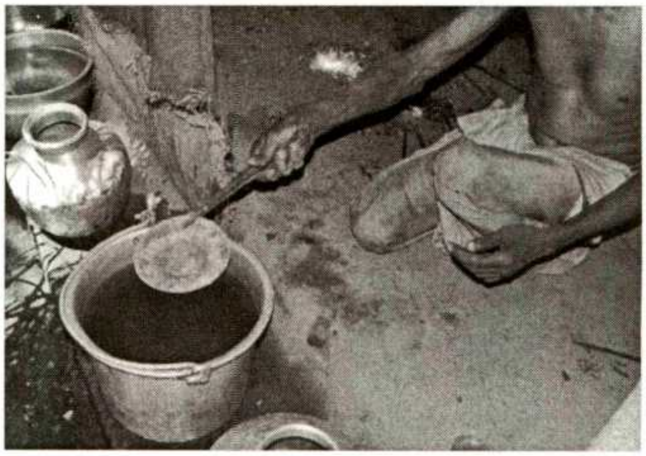

Fig. 14: Quenching of high-tin beta bronze (23% tin) cymbal, Mallapuram, Kerala

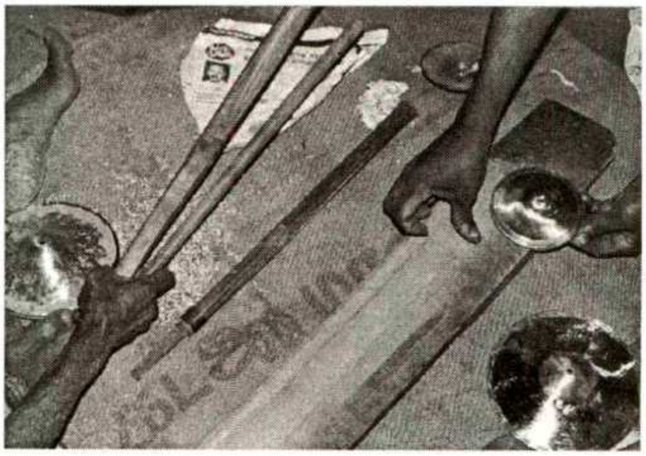

Fig. 15: Polishing and scraping of quenched high-tin bronze musical cymbals, Mallapuram, Kerala

B.C. with relatively few habitation sites having been found close to megalithic burials. However, it is interesting that even in the absence of typical urban characteristics such as structural remains, there is some evidence for other features associated with urbanism such as writing, literature and evidence of long distance exchange. For example, forms of graffiti or writing thought to be related to Tamil Brahmi are claimed to be found on potsherds from sites such as Kodumanal. Intriguingly, finds of writing resembling Tamil Brahmi were reported from three urns excavated in 2004 by T. Satyamurthy, ASI, Chennai, from the impressive urn burial site of Adichanallur that may date back to the 7th or 8th century B.C., and which may throw new light on the origins of writing in South Asia according to S. Deraniyagala of ASI, Sri Lanka (Subramanian 2004). Such finds may also have significance with respect to understanding the emergence of the fine but enigmatic corpus of Tamil Sangam literature, loosely dated to the 5th century B.C. to 5th century A.D. That the early Sangam era may have coincided with the iron age megalithic period (first millennium B.C.) is suggested by references to stone megaliths, including urn-burials and cist-burials (Narasimhaiah 1980: 188).

Finds from megaliths in southern India point to long distance exchange networks even in an era slightly preceding the true early historic period. Berenike in Egypt principally traded in stone and quartz beads with sites in Tamil Nadu such as the megalithic burial-cum habitation site of Kodumanal (*c.* 300 B.C.) and in glass beads from Arikamedu until the 2nd century (Francis 2002). Finds of carnelian and of lapis lazuli from megalithic Kodumanal probably had their sources in western India and Afghanistan respectively. A copper alloy tiger figurine from megalithic Kodumanal inlayed with carnelian and lapis lazuli may be seen to share affinities with an early historic carnelian tiger found in Thailand and reported in Glover (1990).

The high sophistication of numerous vessels and gold jewellery uncovered from the Nilgiri cairns (loosely dated from about 1000-500 B.C.) and Adichanallur burials (*c.* 1000-800 B.C.) led scholars to speculate whether they were imported (Leshnik 1974, Knox 1985; Rajpatik and Seeley 1979), especially since the best documented studies on high-tin bronzes come from Ban Don Ta Phet in Thailand, *c.* 4th century B.C. However the author has argued (Srinivasan and Glover 1995, Srinivasan 1997b), as also indicated in this paper, that technical studies now suggest that it is most likely that the analysed vessels, which were of high-tin beta bronze, were of local provenance. This is also supported by evidence of a long standing local tradition continuing to the present-day especially in Kerala. In fact, the Nilgiri and Adichanallur vessels rank amongst the most elegant and early examples of high-tin bronze metalware. The collection of vessels from the Nilgiri hoards in the British Museum numbers no less than 40, and in particular comprise elegant fluted, knob-based and carinated vessels with concentric rings, etc. The elongation and degree of hot forging in these samples is far greater than that seen in the high-tin bronzes from Thailand suggesting a greater mastery of the technique in the south Indian megalithic high-tin bronzes. At any rate, evidence for long-distance contact with Southeast Asia is suggested in the stylistic similarities that knob-based and ringed bowls from the Nilgiri cairns showed with vessels from Ban Don Ta Phet (*c.* 4th century B.C.). This suggests that maritime interactions between southern India and southeast Asia were prevalent even in an era predating the better documented Roman maritime trade.

Although it was previously thought that due to the scarcity of tin in south India, skilled bronze traditions may have not been supported, the analyses of old slags from Kalyadi, Karnataka by the author suggest otherwise. In fact Maloney (1975) suggests that a reference from Solomon's time concerns the export of tin from the coast of Karnataka. The Dambal region of Karnataka is reported by GSI-Bangalore Circle to have had sparse tin reserves and it may be noted that if alluvial tin had been mined completely, it would not leave many traces.

Ray (1996) has suggested that rather than primarily attributing social change in peninsular India to Mauryan intervention, the impetus from coastal and maritime interactions should also be taken into account. A major trade route in the early historic period was the route from the Malabar coast in the west through the Palghat pass, and moving east to the Kaveri delta with its settlements including sites such as Kodumanal, Karur, Arikamedu, Korkai and Alagankulam (Thapar 2002: 237). Parasher-Sen (2000) also points to the significance of local developments in the Deccan in terms of the origin of settlements. Tamil Sangam works such as the *Ettuttokai* refer to a prosperous people living in Tamil Nadu and Kerala who had seafaring trade with the Yavanas or Mediterranean people and with the island of Savakam, thought to be Java in Southeast Asia (Marr 1985). The above discussion also suggests that the existence of skilled metallurgical or craft techniques need not necessarily be linked with settled urbanism and indeed, even till recently in India, many crafts such as metal crafts were practiced as an itinerant or migrant trade.

Postulating a Musical Significance for the Megalithic High-tin Bronze Vessels

While the megaliths themselves, not to mention the megalithic high-tin bronze bowls, remain an enigma, another matter for speculation is that of the function of these highly specialised bronze bowls. One possibility could have been ritual function, and indeed the notion of the raised knob-base surrounded by rings and the floral lotus patterns seen on some Nilgiri bowls and links with bowls from Thailand, have made some commentators such as Glover (1990) speculate on ritual associations with Buddhism. This is seen from the decorations especially the raised knob-base and rings representing mount Meru in the centre. Of course, in practical terms, the functionality of high-tin bronze for storing food due to its less corrosive properties, has been observed by the author in Kerala.

However, a third possibility postulated by the author is that the vessels may have been used for their musical significance even as far back as the megalithic period. This is because the quenched high-tin bronze alloy is found to have good musical properties and is used for making cymbals even today. The grounds for suggesting that its musical properties may have appealed even in megalithic times comes from recent publications by Boivin (2004) that clusters of rocks with depressions from the Neolithic site of Kupgal in Karnataka in southern India could have been used for making ringing or percussion sounds.

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Flood Plain Record of the Southwest Indian Monsoon During the Last Glacial

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Abstract

Rapid oscillations in the intensity of the Southwest Indian monsoon during the last glacial phase have been inferred for the first time, from newly generated continental records from the site of Bhimpura, located in the Mahi river flood plain in the tropical semi-arid parts of western India. The flood plain sediment belonging to the Last Glacial is characterized using grain size, degree of sorting, sediment facies, magnetic susceptibility, carbonate percentages (calcrete, $CaCO_3$ and calcite), opaque magnetic heavy minerals, common rock forming minerals, and clay mineral percentages. Synthesizing these climate sensitive variables, seven flood periods and non-flood periods are identified. These episodes reflect strong and weak monsoonal phases at a time scale of a few thousand years.

Introduction

The major climatic system influencing South Asia is the Southwest Indian Monsoon (SwIM), which controls the agricultural economy of this region. The long term dynamics of SwIM are understood by analysing sediment cores from different parts of the Indian ocean, Arabian sea and Bay of Bengal (Gupta and Thomas 2003; Altabet *et al.* 2002; Thamban *et al.* 2001; Sarkar *et al.* 2000; Leuschner and Sirocko 2000; Schulz *et al.* 1998; Colin *et al.* 1998; Wang *et al.* 1999; Overpeck *et al.* 1996; Sirocko *et al.* 1993). It is known that the release of heat over the Qinghai-Tibetan Plateau drives the SwIM towards the continent (Overpeck *et al.* 1996; Thompson *et al.* 1997). Rangarajan and Sant (2000) reasoned that the Arabian Sea sediments are influenced by the influx of melt water from the Himalayas. Further, Sant and Rangarajan (2002), using marine and ice core records from around the world, rationalized leads and lags for the onset of a climate change, including change in the SwIM.

A network of streams sculpture the continent. Both small and large drainage systems respond to climate change in terms of change in sediment character. Studies on continental sediments have led to an understanding of the response of continents to climate change (for China: Porter 2001; Xiao *et al.* 1995; Porter and An 1995, Kohfeld 2001, for Africa-Madagascar: Gasse and Van Campo 1998; Bonnefille and Charlie 2000; and for India: Singh 2004; Sinha *et al.* 2004; Kale *et al.* 2004; Juyal, *et al.* 2004; Sant *et al.* 2004; Jain and Tandon 2003; Juyal *et al.* 2003; Mishra and Rajaguru 2001; Srivastava *et al.* 2001; Juyal *et al.* 2000; Khadkikar *et al.* 1999; Tandon *et al.* 1997; Enzel *et al.* 1999; Andrews *et al.* 1998; Kotlia *et al.* 1997; Wasson *et al.* 1983). Studies of fluvial environments in the world's hyper-arid, arid, semi-arid and dry-sub-humid regions have shown that fluvial sediments in combination with aeolian and lacustrine deposits along with pedogenic and digenetic features, have a high potential for palaeoenvironmental reconstruction (Xiao *et al.* 1995; Knox 2000; Castelltort and Driessche 2003 and references cited therein). Studies in these regions have shown that fluvial deposits have survived subsequent reworking and are preserved as sedimentary successions (Merifield 1987; Reid 1994; Reid and Frostick 1997; Nanson and Tooth 1999 as cited in Tooth 2000). Regional to global level climatic signatures are often well preserved within flood plain sediments (Macklin and Lewin 2003).

In case of monsoonal rivers, where rainfall is seasonal and the region is tectonically stable, the drainage basin response can be attributed largely to a single variable, "the climate". Irrespective of climatic zones and geomorphic setup, major and minor rivers across the Indian subcontinent show a thick sequence of sediment, deposited within the river channel. This further exemplifies the response of streams with respect to regional-global climate. Therefore, characterization of flood plain sediments enables understanding of changes in processes and their intensities. Climate sensitive proxy records as determined from flood plain sediments, facilitates appraisal of climate variability and change. The SwIM has played a crucial role in the deposition of flood plain sediments in the Indian subcontinent (Khadkikar *et al.* 1999; Juyal *et al.* 2000; Srivastava *et al.* 2001; Jain and Tandon 2003; Juyal *et al.* 2004; Sant *et al.* 2004). Therefore, the flood plain sediments preserve the signature of formative processes and thereby record changes in the intensity of the SwIM in response to global climate change. This paper attempts to identify the signatures of the SwIM in terms of flood episodes. In order to understand the regional and global significance, continental data has been generated from Bhimpura (22° 19' 08.58" N; 73°05' 00.97" E, 33.3 m AMSL), from the Mahi flood plain, southern Cambay Alluvial Plain (CAP), tropical western India.

Previous studies undertaken in and around the Mahi and Sabarmati river basins have led to significant progress in understanding various features of Quaternary sediments. These include studies pertaining to stratigraphy and depositional environment (Pant and Chamyal 1990; Merh and Chamyal 1997; Tandon *et al.* 1997; Malik *et al.* 1999; Jain and Tandon 2003); palaeoclimatic reconstructions (Wasson *et al.* 1983; Tandon *et al.* 1997; Khadkikar *et al.* 1999; Juyal *et al.* 2000; Srivastava *et al.* 2001); the role of man in the region (Zeuner 1950; Subbarao 1952; Allchin and Goudie 1971; Allchin *et al.* 1978); and chronology using the thermoluminescence method (Tandon *et al.* 1997; Juyal *et al.* 2000; Srivastava *et al.* 2001; Juyal *et al.* 2003; Juyal *et al.* 2004). In addition to this, some earlier workers have compared sediment units and their chronology within and across the Mahi and Sabarmati alluvial basins (Pant and Chamyal 1990; Chamyal and Merh 1992; Tandon *et al.* 1997; Khadkikar *et al.* 1999; Malik *et al.* 1999; Juyal *et al.* 2000; Srivastava *et al.* 2001; Jain and Tandon 2003).

However, till date, no attempt has been made to characterize flood plain sediment and quantify changes in allogenic and authigenic records through time. Therefore, the present study aims at characterizing continental sediments, analyzing changes in physical and statistical parameters, identifying episodes within broad climatic phase (the Last Glacial), and providing detailed information on temporal (short-term) changes in climate sensitive proxies, in addition to understanding its global status.

Methods of Study

The site of Bhimpura and the Mahi flood plain forms a part of the CAP, a vast stretch of flat land with a mean elevation of 40 m AMSL, spread over the Cambay rift zone between Saurashtra and the Aravalli uplands. The palaeo-Sabarmati, palaeo-Mahi, palaeo-Dhadar and palaeo-Narmada are the important rivers responsible for building up the CAP (Sant and Karanth 1993). The incised flood plain and flood plain dunes within the Mahi and Sabarmati basin structure the topographic expression over the CAP. Geomorphologically the site falls along the eastern bank of the southwestern edge of Mahi flood plain which flows into the Gulf of Cambay (Fig. 1).

The representative samples were collected at 15 cm intervals from a 1513 cm open step-trench at Bhimpura, following recording of sedimentary structures, nature of pedogenesis and other related observable features. A total of 102 samples were collected from this section. In the present paper, proxy records from depths of 433 to 1513 cm are discussed. Granulometric analysis was performed by dry sieving 100 g of bulk sample. Fourteen sieve fractions namely, 420 μm, 250 μm, 210 μm, 149 μm, 125 μm, 106 μm, 90 μm, 75 μm, 63 μm, 53 μm, 45 μm, 37 μm, 25 μm and <25 μm were used. Magnetic susceptibility was measured for bulk sediments using Bartington MS2 Magnetic Susceptibility Meter at two frequencies (0.47 kHz and 4.7 kHz). The low frequency mass susceptibility (χ_{LF} bulk) and frequency dependent magnetic susceptibility (χ_{FD}(%)bulk) were calculated. Frequency dependent magnetic susceptibility was calculated as percentages from the ratio of difference between mass magnetic susceptibility at two frequencies and the low frequency susceptibility. The results are represented as magnetic susceptibility (χ_{LF})bulk and χ_{FD}(%)bulk. Carbonate concentration in the sediment is determined by treating <25 μm grain size fraction with 1N HCL, determining calcrete percentage from bulk 100 gm of sample 420 μm and 250 μm size sieve fractions and quantifying percentage of calcite mineral from X-ray diffractogram using base line fit method. Similarly, other minerals namely, quartz, feldspars, calcites, smectite, chlorite, illite, and hematite were also quantified. Mineralogy was determined by analyzing <25 μm size bulk sample on Philips PW1840 X ray diffraction (Cu Kα source (λ = 1.5418); by scanning between 2Φ ranging from 3° to 40° with a scanning speed of 0.02° per second). Opaque magnetic heavy mineral percentages were calculated for all samples after separation of magnetic minerals using hand magnet from 10 gm of bulk sample. These are evaluated to see their sensitivity to a climate change regionally and globally.

Results and Discussion

Grain size and Sediment facies records

The flood plain sequence at Bhimpura shows trough cross-bedded gravel and sand at the base (1513 to 1203 cm) followed by visually massive unstratified sandy-silty facies (1203 to 433 cm). The sieve fractions from 420 μm and 250 μm yielded calcrete from depths of 433 to 1203 cm whereas, the same sieve fractions from depth 1503 to 1203 cm, yielded medium to coarse sand and gravel. Further sieve fractions at 210 μm, 149 μm and 125 μm together are grouped as fine sand; 106 μm, 90 μm and 75 μm, as very fine sand; and 63 μm, 53 μm, 45 μm, 37 μm, 25 μm and <25 μm as silt (Folk 1974). Grain size fraction is understood in terms of processes. It varies in accordance with discharge and availability of sizes. Granulometric analysis suggests flood plain sediments are deficient in fine silt and clay with dominance of very fine sand.

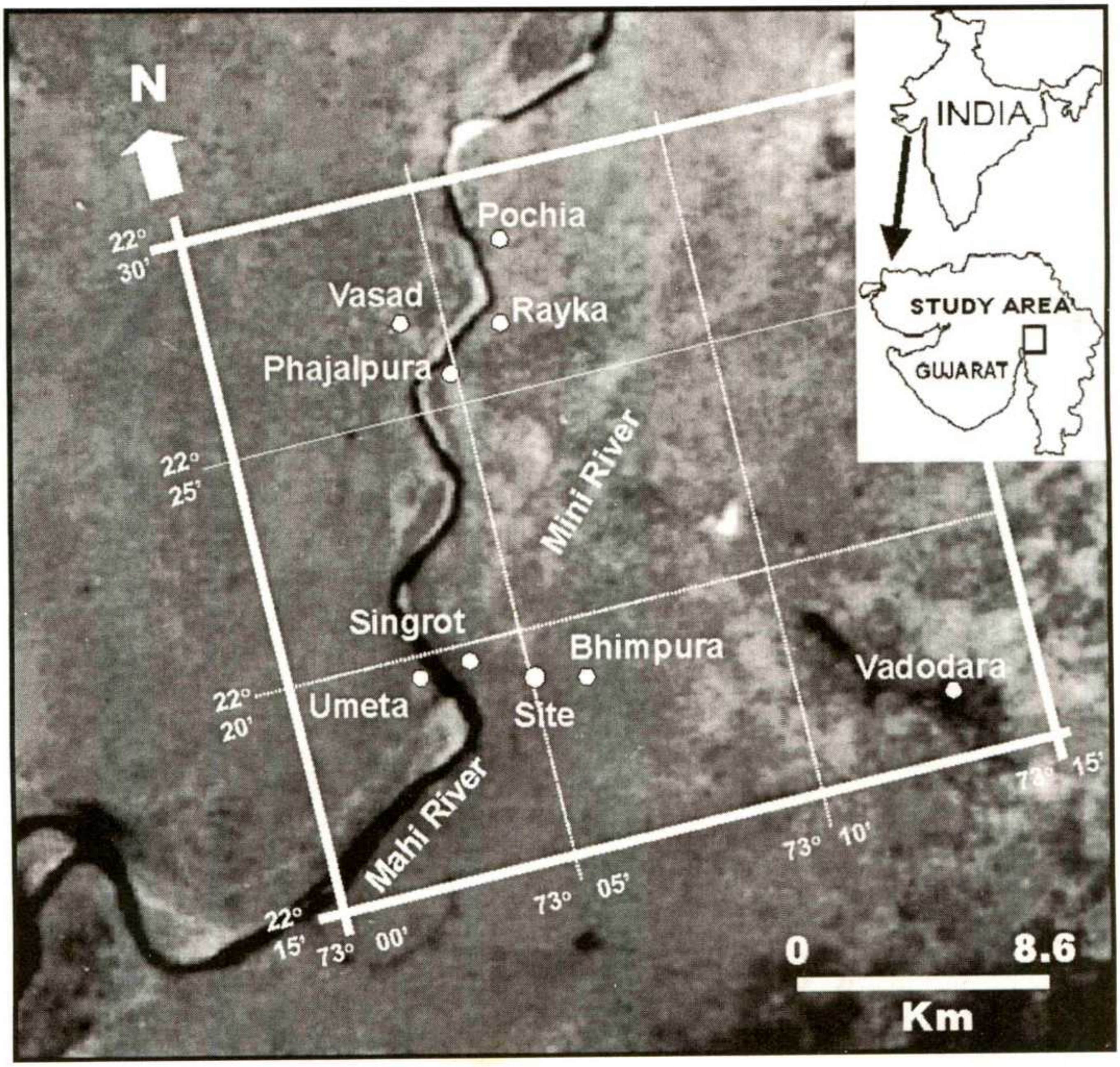

Fig. 1: Satellite image showing flood plain of river Mahi. Various important locations around Bhimpura site are shown therein

Correlation analysis among grain size fractions as well as within subgroups classified based on grain size (Folk 1974), suggests that only few grain size fractions are sensitive to change in process intensity. Such climate sensitive grain size fractions are grouped as an allogenic proxy. In the present case, grain size fractions between 210-149 μm (fine sand) and <25 μm (silt) are found to be sensitive to change in process intensity (Fig. 2). In a semi-arid, monsoonal climate, the flood plain sediment records two important processes; – *viz.* flooding and non-flooding episodes. An increase in the 210-149 μm grain size fractions represents increase in carrying capacity of a river suggesting wetter conditions. Whereas, increase in <25 μm grain size fraction represents comparatively weaker fluvial activity and mobilization and accumulation of fine sand and silt by aeolian activity suggesting a dryer climate. Based on the 210-149 μm and <25 μm grain size fractions we identify seven flooding and non flooding periods during the Last Glacial (see section 4).

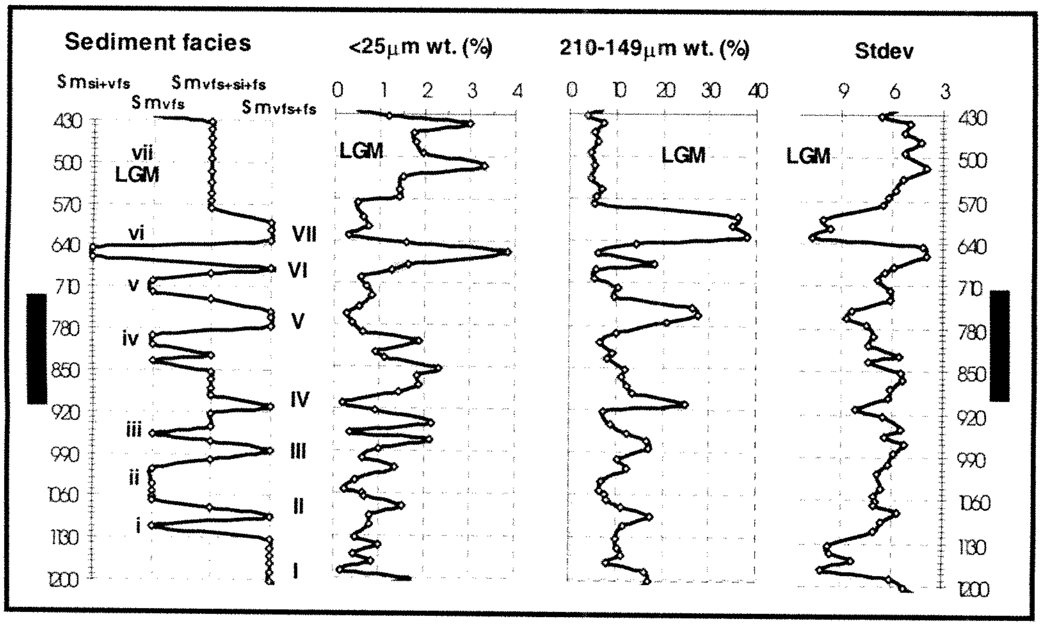

Fig. 2: Variation of sediment facies, weight percentage of <25 µm and 210-149 µm sediment fraction and standard deviation having inverse relationship with degree of sorting along the depth profile for the sediment sequence at Bhimpura site. Numbers i to vii represent non flooding event (cold and dry, stadial type) and numbers I to VII represent flooding event (warm and wet events, interstadial type) Event vii (last stadial) represent Last Glacial Maxima whereas event VII (last interstadial) represent last pre-Holocene fluvial event

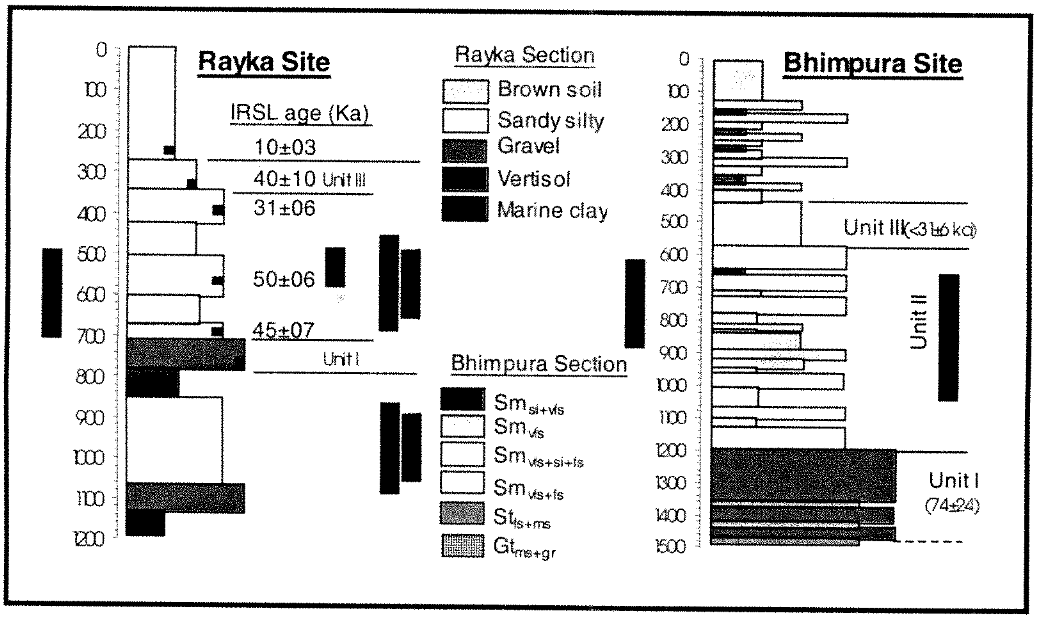

Fig. 3: Comparison of sediment facies and marker horizons for the sequence at Rayka and Bhimpura sites

Standard deviation (Stdev) of the grain size fractions captures the degree of sediment sorting. Increase in standard deviation indicates decrease in degree of sorting and vice versa. The degree of sorting when seen against the depth profile indicates that the sediments during flooding periods are relatively less sorted than sediments deposited during non-flooding events (Fig. 2). Variation in the degree of sorting along the depth correlates directly with 210-149 μm grain size fractions and inversely with <25 μm grain size fraction, thereby suggesting that the degree of sorting is a proxy for the fluctuation of energy conditions during transport and deposition. Thus, variability in degree of sorting is understood here as being sensitive to climate changes.

Cluster analysis and field characters are used to determine the facies type. Six sedimentary facies have been identified for the floodplain sequence at Bhimpura from a total depth of 1513 cm (Figs. 2-3). They are
(i) trough cross-stratified gravel + medium grain sand facies (Gt) (16 samples analysed: 78% gravel + coarse to medium sand, 16% fine sand; 5% very fine sand and 1% silt), (ii) Trough cross-stratified medium sand + fine sand facies (St_{ms+fs}). (6 samples analysed: 73% medium sand, 21% fine sand, 5% very fine sand and 1% silt);
(iii) Massive unstratified very fine sand + fine sand (Sm_{vfs+fs}) (16 samples analysed: 48% very fine sand, 42% fine sand and 10% silt); (iv) Massive unstratified very fine sand + silt + fine sand ($Sm_{vfs+si+fs}$) (22 samples analysed: 61% very fine sand, 18% fine sand and 21% silt);
(v) Massive unstratified very fine sand (Sm_{vfs}) (30 samples analysed: 73% of very fine sand 14% fine sand and 13% silt) and (vi) Massive, unstratified silt + very fine sand (Sm_{vfs+si}) (7 samples analysed: 59% very fine sand, 30% silt and 11% fine sand).

The intercalated sequence of Gt and St_{ms+fs} facies forms the base of the flood plain sequence from a depth 1513 cm to 1203 cm (Fig. 3). This 310 cm thick sediment is poorly sorted. The bulk sediment comprises of gravel size clasts of calcrete and basalt supported by medium-fine grained sand. Gt and St both show trough cross-stratification, that dips 15-17° due east. Calcrete grains are of various shapes and sizes. The maximum elongation of calcrete clasts observed is 18 cm. Rhyzoliths are well developed within St_{ms+fs}. Rhyzoliths have a maximum diameter of 8 mm. Gt and St_{ms+fs} facies occurs laterally within and across the Mahi basin as the base of massive unstratified silty sandy sediments. Gt and St_{ms+fs} facies reflect a very strong fluvial regime possibly during the late Last Interglacial.

The massive unstratified silty sandy sediments show intercalation of Sm_{vfs+fs} facies with Sm_{vfs+si} – Sm_{vfs} – $Sm_{vfs+si+fs}$ facies, from depth 1203 cm to 580 cm (Figs. 2 and 3). Sm_{vfs+fs} facies are deposited with a flat base, capped or underlaid by a sharp contact with Sm_{vfs+si} – Sm_{vfs} – $Sm_{vfs+si+fs}$ facies sub-units, suggesting a heterogeneous amalgamation of sediment facies. Sm_{vfs+fs} facies shows increase in 149 μm grain size fraction, decrease in <25 μm grain size fraction and degree of sorting suggesting a channel sheet deposit of a shallow flooding river. The Sm_{vfs+si} – Sm_{vfs} – $Sm_{vfs-si+fs}$ facies shows overall increase in <25 μm grain size, decrease in 210-149 μm grain size and have a relatively moderate to low degree of sorting (Figs. 2 and 3). Sm_{vfs+fs} facies represent fluvial process whereas Sm_{vfs+si} – Sm_{vfs} – $Sm_{vfs+si+fs}$ facies represent fluvio-aeolian processes.

The sediment from 580 cm to 433 cm includes 147 cm of uniform $Sm_{vfs+si+fs}$ facies capping the last extreme flooding period (Event VII: Figs 2 and 3) marked by Sm_{vfs+fs} facies. Development of uniform $Sm_{vfs+si+fs}$ facies suggests dominance of a single process. $Sm_{vfs+si+fs}$ facies show an increase in <25 μm, flattening of 210-149 μm and increase in degree of sorting. $Sm_{vfs+si+fs}$ facies suggests strong aeolian activity in the region during non-flooding periods (Event vii: Figs. 2-3).

In summary, the presence of dune fields within the Mahi and Sabarmati flood basins suggests the role of strong winds and/or low vegetation cover in redistributing available fine sediment within and across the flood plains. Thus four allogenic proxies namely 210-149 μm and <25 μm grain size fractions, standard deviation and sediment facies are identified as climate sensitive (Fig. 2). Seven flooding and non-flooding periods have been identified at the Bhimpura site.

Opaque magnetic heavy mineral records

Opaque, magnetic minerals are separated using a hand magnet taking ten grams of bulk sample. Such separation is the initial step for preparing samples before running the sample through a Frantz Magnetic Separator, as such minerals adhere to pole pieces and interfere with flowing tracks (Hess 1966). Each magnetic fraction is weighed and finally converted to its weight percentage. This method was repeated until all Opaque magnetic heavy minerals were separated. For further confirmation, the procedure for a few samples was repeated ten times. The results show a repeatability of up to 98%.

Given the same sediment provenance of the streams an increase or decrease in opaque mineral concentration reflects intensity of transport process. The heaviness of Opaque magnetic heavy mineral causes them to travel along with medium to fine grain sediments in accordance with the relationship between specific gravity and grain size (Folk 1974; Friedman and Sanders 1978). Increase in the Opaque magnetic heavy mineral concentration is suggestive of higher energy conditions. Hence, identification of flood events can be done by observing increase in

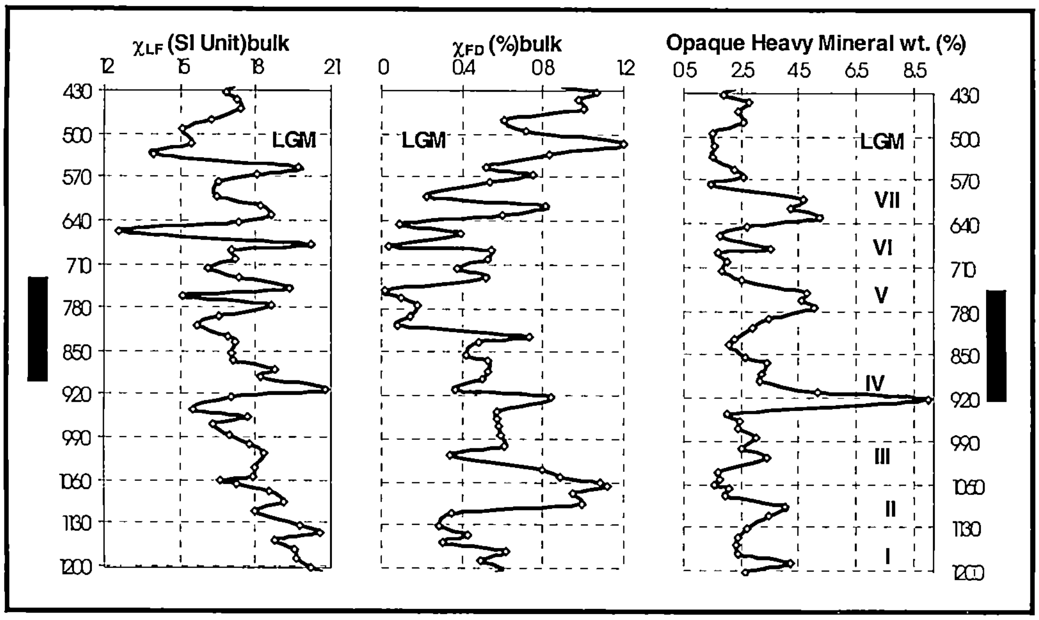

Fig. 4: Variation of Magnetic susceptibility and Opaque magnetic heavy mineral percentage along depth profile for the sediment sequence at Bhimpura site

ferromagnetic mineral concentration (Fig. 4). It was observed that an increase in Opaque magnetic heavy mineral concentration occurred with increase in the 210-149 μm grain size fraction, thus justifying seven flood periods (Figs. 2 and 4).

Magnetic susceptibility records

Magnetic susceptibility studies of Chinese loess suggest that low frequency mass susceptibility (χ_{LF}), reflects high-grade pedogenesis whereas frequency dependent magnetic susceptibility (χ_{FD}(%)) records low grade weathering (Heller *et al.* 1991; Guo *et al.* 2000). In the flood plain sediment both allogenic and authigenic processes (pedogenesis and early diagenesis of flood plain sediments) occur together. To differentiate authigenic signatures from allogenic we compare magnetic susceptibility records with Opaque magnetic heavy mineral percentages. Fig. 4 shows increase in χ_{LF}bulk indicating an increase in Opaque magnetic heavy mineral concentration. An increase in χ_{FD}(%)bulk with a decrease in Opaque magnetic heavy mineral captures pedogenesis. χ_{FD}(%) bulk captures secondary enrichment of ferrous/ferric iron due to pedogenesis. Further, χ_{LF}bulk and χ_{FD}(%)bulk record shows an inverse relationship (Fig. 4). Four pedogenic horizons identified based on χ_{FD}(%)bulk are at depths 1040 cm to 1096 cm, 825 cm, 732 cm to 687.5 cm, 577 cm to 430 cm, Each pedogenic horizons was developed within Sm_{vfs} facies just above the fluvial sand. In the field, one can identify them as a moderate pedogenic horizon as it has not attained a definite palaeosol status.

Carbonate records

Variation of carbonates (calcrete, $CaCO_3$ and calcite) signifies understanding of authigenic processes. Andrews and others (Andrews *et al.* 1998), describe calcrete carbonate formation in a monsoon setting. Calcrete precipitation takes place after the rainy season (after July to August in modern SwIM) by downward leaching of soluble $CaCO_3$ and its accumulation at the evapotranspiration front (Courty *et al.* 1987). Thus, October to March is the probable time for the formation of these Indian calcretes. Another possibility is that calcrete is a result of surface evaporation of water. Increased evaporation is also likely to be an indicator of a more arid environment.

Carbonate percentage from depth 1133 to 880 cm increases from 18% to 63%, and thereafter fluctuates between 30-45%. Nevertheless, the calcrete and calcite percentages show a positive relation with <25 μm grain size fraction and at the same time an inverse relation with 210-149 μm grain size fraction, sediment facies and Opaque magnetic heavy mineral percentage (Figs. 2, 4, and 5). Based on percentages of calcrete and calcite, we are able to distinguish five horizons at depths; 1096 cm to 1016 cm, 985 cm to 911 cm, 880cm to 825 cm, 732 cm to 687 cm, and 577 cm to 430 cm. These represent periods of relatively more aridity (Fig. 5).

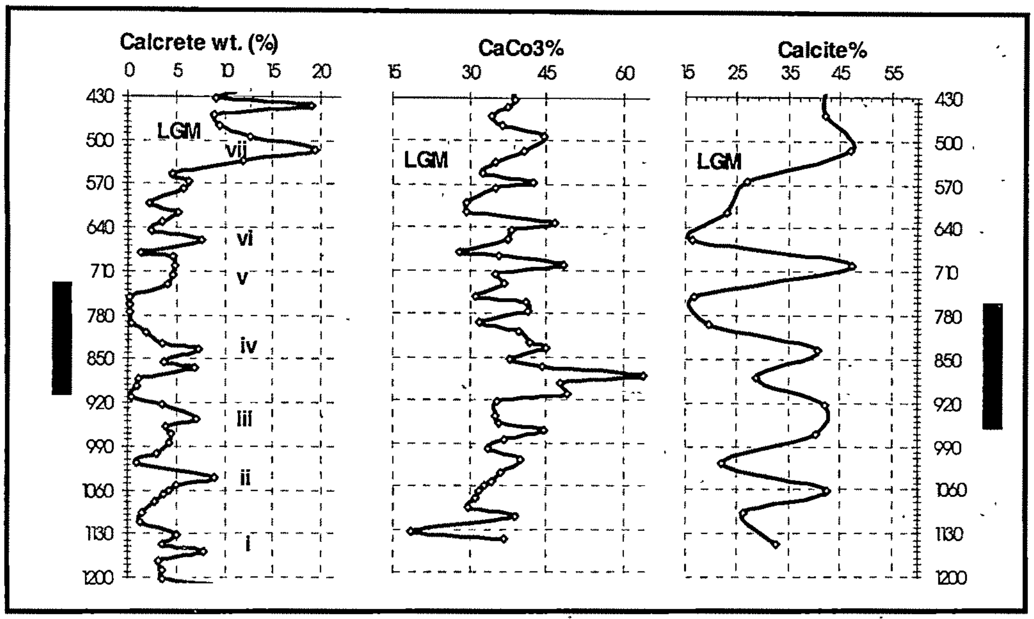

Fig. 5: Variation of Carbonates percentage (calcrete carbonate, $CaCO_3$ and mineral calcite) along the depth profile for the sediment sequence at Bhimpura site

Mineralogical records

Composition of sediment is determined from the assemblage of common rock forming minerals (quartz and feldspar), clay minerals (smectite, chlorite, illite) and other secondary minerals (calcite and hematite). Quartz and feldspars (sp. gr. 2.65-2.76) either reflect an increase or decrease in sediment discharge. Clay minerals within the sediment would represent both allogenic and authogenic transformations. Allogenic component is understood with increase or decrease of clay minerals depending on fractionation based on their density, smectite 2-2.6 gm/cc (lowest density); Illite 2.6-2.9 gm/cc; chlorites 2.6-3.3 gm/cc (highest density) (Deer *et al.* 1966 as cited in Totten *et al.* 2002).

It is possible to infer that in the zone where calcrete is enriched, the percentage of smectite increases while the illite percentage decreases. This is due to alteration of illite under alkaline conditions. There is a distinct change in the mineral percentages from a depth of 640 cm upwards. Quartz and feldspars decreases, illite percentages follow the same trend whereas smectite increases. Therefore, mineral percentages indicate a major change in the type of depositional processes (Fig. 6), which can be correlated with climatic signatures deduced from the aforesaid parameters. In a clay-silt deficient flood plain sediment, the concentration of clay minerals (smectite, illite and chlorites), however small are significant.

Age Bracket of the Sedimentary Sequence

Variation in sedimentary facies along a depth profile for Rayka and Bhimpura sites are recorded in Fig. 3. Vertisol (10 YR 7/4, very pale brown) forms the base of the sequence. At Rayka sites, vertisol is well documented whereas at the Bhimpura site, the presence of vertisol is inferred to extend below Gt and St_{ms+fs} facies based on neighboring sections. The vertisol is overlain by Gt and St_{ms+fs} facies (10 YR 6/4, light yellowish brown) at Rayka and Bhimpura. We identify this as Unit I. Unit II, immediately overlying Unit I, comprises intercalated Sm_{vfs+fs} facies (10 YR 7/6, yellow) and Sm_{vfs+si} – Sm_{vfs} – $Sm_{vfs+si+fs}$ facies (10 YR 6/6, brownish yellow) sequence at Rayka and Bhimpura sites. Finally, the sequence is capped by a thick pedogensied $Sm_{vfs+si+fs}$ facies (10YR 7/6, yellow) is identified as Unit III.

Both the sections, Rayka and Bhimpura, show three significant marker horizons based on sediment characteristics (Figs. 2 and 3). The first marker is Unit I. The second marker is the sandy facies immediately overlaying Unit I at Rayka and Bhimpura. The upper most portion of Unit II with sandy facies forms the third marker (Rayka, 476 cm to 400 cm; Bhimpura, 659 cm to 577 cm). The third marker is immediately overlain by a pedogensied sandy silt facies along various sections within the Mahi basin. The lateral extension of all these markers has been traced throughout the study area.

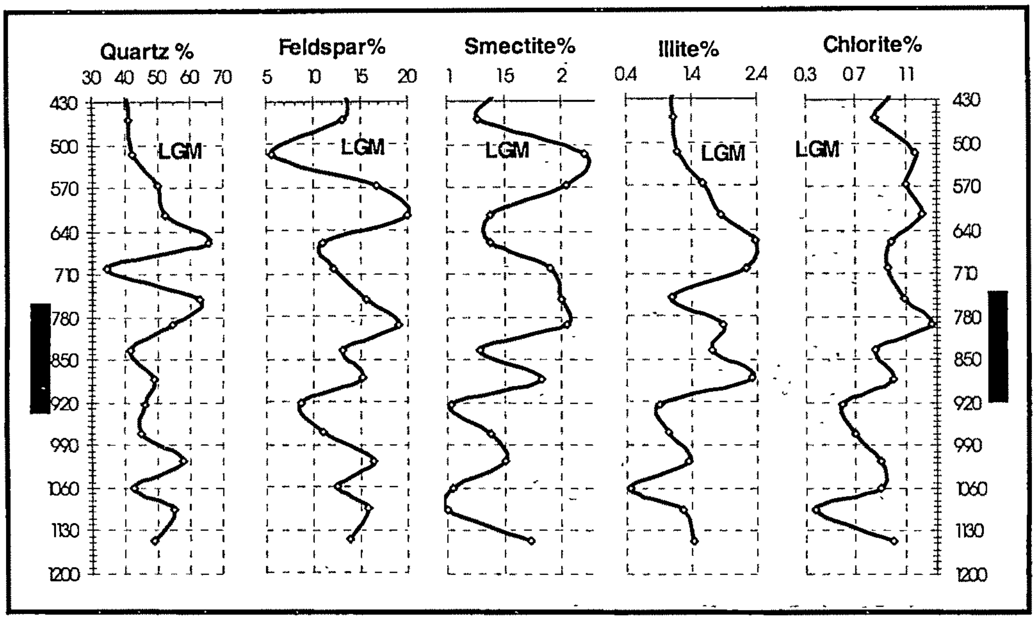

Fig. 6: Variation of common rock forming and clay minerals in percentages along the depth profile for the sediment sequence at Bhimpura site

The chronological data for the Rayka section suggests that the age of the first marker is 74±24 ka. The second marker is dated to about 50 ka (between 50±6 ka and 45±7 ka) while the third marker is dated to 31±6 ka. (Juyal *et al.* 2000). Therefore the age of Unit I falls around 74±24 ka whereas Unit II spans a period ranging from 50 ka to 31±6 ka. Unit III fall around <31±6 ka. Thus, the flood plain most of the sequence spans over most of the Last Glacial.

Climate Change: A Synthesis

The identification of short-term climatic episodes (flooding and non-flooding episodes) from the Bhimpura flood plain sediments, is based on climate sensitive parameters in flood plain deposits discussed above. In all, seven flooding and non-flooding episodes are identified based on these parameters from depths of 433 cm to 1202 cm. The 769 cm thick intercalated sedimentary sequence (Sm_{vfs+fs} facies intercalates within Sm_{vfs} – $Sm_{vfs+si+fs}$ – Sm_{si+vfs} facies) spans the Last Glacial.

Flooding episodes (I to VII) are characterized by Sm_{vfs+fs} facies. Increase in 210-149 μm grain size fraction, Opaque magnetic heavy mineral percentages and decrease in degree of sorting, and χ_{LF}bulk characterizes flooding episodes (Figs. 2 and 4). The behaviour of these climate sensitive parameters suggests that these episodes had a relatively high sediment carrying capacity. Based on this, it is inferred that during these periods, torrential rains led to flash floods in the shallow river channels (Ice Age rivers). The transitory, short-lived rivers during the Last Glacial were dependent entirely on the SwIM leading to rapid denudation.

Non-flood episodes (i to vii) are characterized by Sm_{vfs} – $Sm_{vfs+si+fs}$ – Sm_{si+vfs} facies. Increase in the <25 μm grain size fraction, degree of sorting, χ_{FD}bulk, and calcrete percentages along with a decrease in Opaque magnetic heavy mineral, quartz and feldspar percentages (Figs 2, 4, 5 and 6) characterize non flooding episodes. Variation in the concentration of the said parameters suggests a feeble carrying capacity of these rivers. It further suggests that during a non-flooding climate phase, rivers were sluggish, with reduced erosion. Reduction and prolongation of the SwIM would increase the rate of evaporation, and decrease vegetation cover, initiating reworking of moisture free sediments by strong winds. This additional process within the flood plain resulted in development of sheets and dunes. The increase in <25 μm grain size fraction, degree of sorting, χ_{FD}bulk, and calcrete percentages supports this view (Figs. 2, 4-5).

Moreover, during non-flood episodes, there is a decrease in precipitation, which influences the chemistry of ground water leading to authigenic changes. The role of authigenic processes in the sediments is represented by percentages of carbonate, calcrete carbonates and calcite (Fig. 5). One of the important authigenic activities in monsoonal setting is the result of downward leaching of soluble $CaCO_3$ or surface evaporation. We observe increase in calcrete carbonate and calcite during non flood episodes correlated with the quantity of the <25 μm grain size fraction. Further an alkaline environment during non-flood episodes seems to have allowed transformation of illite to smectite (Fig. 6). Clay minerals such as smectite, illite, and chlorite reflect a significant change between 640 cm to 570 cm (Fig. 6).

Thus, the present allogenic and authigenic records from the flood plain sediment significantly contributes to characterizing both flooding as well as non-flooding episodes. These events directly point towards variations in the SwIM intensity over the scale of a few thousand years during the Last Glacial that led to aggradation and avulsion.

Analysis of ice cores (Polar: Jouzel *et al.* 1987; Greenland ice core project members 1993; Grootes *et al.* 1993; Dansgaard *et al.* 1993) and ocean core sediments (Atlantic and Indian Ocean: Ruddiman 1977; Bond *et al.* 1992; Grousset *et al.* 1993; Schulz *et al.* 1998; Colin *et al.* 1998; Heinrich 1988; Leuschner and Sirocko 2000; Altabet *et al.* 2002) have also revealed that climate fluctuated during the Last Glacial, evidence of which is preserved as abrupt climatic events. These short-term, warm and wet climatic events (interstadials) are globally expressed in terms of Dansgaard-Oeschger (D/O) events, which culminated with relatively long term dry-cool cycles (stadials) called Heinrich events (Ruddiman 1977; Heinrich 1988; Bond *et al.* 1992; Dansgaard *et al.* 1993; Grousset *et al.* 1993). In China and Central Asia, these short-term abrupt climatic events are identified, on the basis of studies on grain sizes of loess sediments(Porter and An 1995; Porter 2001). The coarsening of grain size in Chinese loessic sediments is inferred as representing the Heinrich event. The mechanism suggested to explain this process is increase in continental wind speed and aridity. Further, it is also observed that the type of fluctuations in grain size (which is a proxy to river discharge and on-land weathering processes) of sediments in the Bay of Bengal – Andaman sea (site MD77-169 and MD77-180) is comparable with D/O type fluctuations. These fluctuations indicate an increased summer monsoon during D/O, and significantly drier conditions during Heinrich events (Colin *et al.* 1998). The D/O variability of the Indian monsoon is also revealed in the Arabian Sea record (site 93KL: Schulz *et al.* 1998).

In the light of these observations, flood episodes deduced from the Bhimpura site could be interpreted as being under the direct influence of D/O type fluctuations. High-resolution climate sensitive proxies and chronology for flood plain sediments would further confirm continental response to such abrupt events.

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Early Agriculture in Orissa: Some Archaeobotanical Results and Field Observations on the Neolithic

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Abstract

The development of agricultural communities is poorly understood in the state of Orissa. This is not due to a lack of archaeological sites, because there appear to be many, but the result of no systematic environmental sampling and flotation. Orissa is potentially an important area in terms of agricultural development and may be crucial for understanding broader patterns of early agriculture in India as a whole. A number of crops may have originated in this region including rice, pigeonpea, urd and mung bean, several gourds, and root crops such as taro and yams. The investigations into these particular issues began with intensive field explorations and the recovery of archaeobotanical samples from a number of sites across the state by the Deccan College, Pune. Preliminary results of analysis for macro-botanical remains from some of these sites are presented here along with a review of the types of sites found so far and a summary of what this means in terms of the development of agricultural communities in this area.

Introduction

Food production is arguably the most important cultural change since the Palaeolithic, providing in many parts of the world a basis for sedentism and in all cases the basis for surplus subsistence production that could support states and "civilisation". The transition in any particular region from a reliance entirely on hunting and gathering to primarily food production through herding and cultivation is therefore of prime archaeological interest. This interest may occur through the local domestication of species available in the wild or through the adoption of crops/animals by hunter-gatherers or by the immigration and colonization of a region of farmers from elsewhere. In order to investigate which process was at work in an area's past, and before it is even possible to speculate about causes, it is necessary to know what the basis of early food production was, and which crop species and animals contributed to this transition. The most direct evidence for crop cultivation in the past comes from archaeobotany; the study of plant remains preserved at archaeological sites. Such remains are normally preserved in carbonized form, by ancient contact with fire, and can be recovered through the processing of sediment using flotation (Kajale 1977; Buth *et al.* 1988; Fuller 2002: 257ff.). Those species recovered and identified can then be considered with regards to evidence from modern botany, genetics, and geography as to the regions in which they occur wild and therefore must have been domesticated (for a recent review see Fuller 2002: 284-316; Fuller 2003a). This can then be used to compare the food production in different sites, regions, and periods. Currently available evidence from prehistoric/protohistoric India is patchy, which means the beginnings of agriculture in many regions are completely unknown. The relationship between early agriculture and the emergence of Neolithic cultural traditions, although often assumed, needs to be documented, and the present paper reports results from new investigations in Orissa that aim to shed light on these issues (Fig. 1).

Orissa provides interesting prospects for archaeological investigation of early agriculture as well as being potentially a crucial region for understanding broader patterns of early agriculture in India as a whole. The topographical and ecological diversity of Orissa and adjacent regions, especially the tribal zones of Western Orissa, Chattisgarh (formerly eastern Madhya Pradesh) and Jharkhand (formerly southern Bihar), provide the natural habitat for a wide diversity of edible plants, including the wild relatives of many crops. Table 1 provides a list of crop species that are candidates for domestication in the region based on the presence of wild progenitors in this area, although many of these species are also distributed more widely in India (see Fuller 2002).

Of particular note is the presence of candidate populations of the wild progenitors of *indica* type cultivars of Asian rice (*Oryza sativa* subsp. *Indica*). Genetic

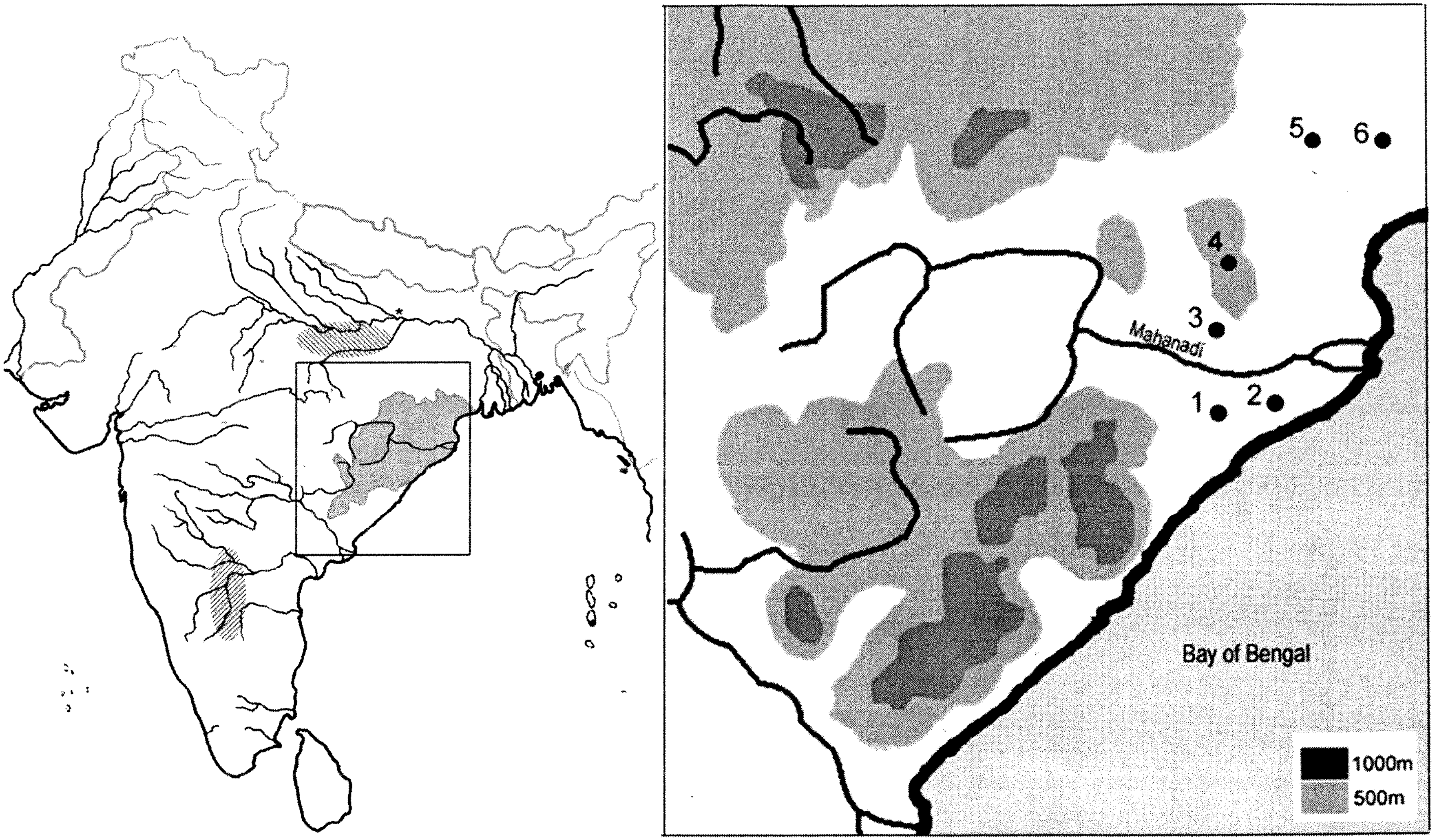

Fig. 1: Map of Orissa marked with sites. Map of India indicates the state of Orissa (grey) and other Neolithic regions (hatched) of possible indigenous domestication of the same or related crop species to those found in Orissa, the Vinhdyan Neolithic and the Southern Neolithic/ Ash Mound Tradition. Key to sites: 1 - Gopalpur; 2 - Golbai Sasan; 3 - Khameswaripalli; 4 - Malakhoja and Bajpur; 5 - Banabasa; 6 - Kuchai

Table 1: List of crop species that are candidates for domestication in Orissa

Crop	Common name	Region of Origin
Oryza sativa L.	Rice, vrihi	Tract from Central Uttar Pradesh, Chattisgarh, Bihar, west and south Orissa
Pulses		
Vigna mungo (L.) Hepper	Black Gram, Urd	South Asia – northern extent of wild progenitor could include Vindhyas and Orissan hills (?)
Vigna radiata (L.)	Green Gram, Mung	South Asia – northern extent of wild progenitor could include Vindhyas and Orissan hills (?)
Macrotyloma uniflorum (Lam.) Verdcourt	Horsegram, Kulthi	South Asia: savannahs or dry deciduous woodlands
Cajanus cajan (L.) Millsp.	Pigeonpea, Red Gram, Tuvar	South Orissa, Bastar
Cucurbits (Cucurbitaceae)		
Cucumis sativus L.	Cucumber, khira	Wild in the Himalayan foothills, possibly also the high hills of Orissa
Coccinia grandis (L.) Voigt	Ivy gourd, kunduri	Wild/feral in Himalayan foothills, hills of central and eastern India
Trichosanthes cucumerina L.	Snake gourd, chachinga	Wild/feral in Himalayan foothills, hills of central and eastern India
Praecitrullus fistulosus (Sticks) Pang.	Tinda, Indian squash melon	Wild/feral in Himalayan foothills, hills of central and eastern India
Momordica charantia L.	Bitter gourd, karela	Wild/feral in Himalayan foothills, hills of central and eastern India through Southeast Asia
Momordica dioeca Roxb. Ex Willd.	Small bitter gourd, murela, jangli karela	Wild/feral in Himalayan foothills, hills of central and eastern India through Southeast Asia
M. balsamina L.	Balsam apple, mokha	
Luffa cylindrical (L.) M.J. Roem.	Sponge gourd, loofah	Wild/feral in Himalayan foothills, hills of central and eastern India through Southeast Asia
Luffa acutangula (L.) Roxb.	Ridged gourd, angled loofah	Wild/feral in Himalayan foothills, hills of central and Eastern India
Tubers		
Colocasia esculenta	Taro	Eastern India and/or SE Asia
Dioscorea spp.	Yams	Eastern India and/or SE Asia

evidence is clear in indicating a minimum of two domestications for *Oryza sativa* (reviewed in Fuller 2002: 296-300; Chen *et al.* 1993; Wan and Ikehashi 1997; Sato 2002; Vaughan et al 2003; Cheng *et al.* 2003), including one from perennial wild rice (*Oryza rufipogon sensu stricto*) that led to *japonica* type cultivars, and probably occurred in the Neolithic of the Yangzi basin China (Cohen 1998; Zhao 1998), and the other from annual wild rice (*Oryza nivara*) giving rise to *indica* cultivars. For ecological reasons we would expect the *nivara-indica* domestication to have occurred in the seasonally dry tropics as argued by Sato (2002). This brings tracts of India into consideration from central Uttar Pradesh, through Chattisgarh, Bihar, and western/southern Orissa.

Other crops may have also originated here. The Northeastern limits of the wild form of mung and/or urd (*Vigna sublobata sensu lato,* giving rise separately to *Vigna radiata* and *Vigna mungo*) probably extends to this area but requires botanical field investigations. Horsegram (*Macrotyloma uniflorum*), although definitely of South Asian origin, has a poorly documented wild progenitor and its region of origin, or multiple loci of origin, within South Asia cannot yet be localized, although at least one domestication from southern India has been argued (Fuller 2002; Fuller *et al.* 2004). One species which is clearly of eastern Indian origin is red gram/ pigeon pea (*Cajanus cajan*), the wild form of which (*Cajanus cajanifolia*) is distributed in the Bastar region of Chattisgarh, in Southern Orissa, and adjacent northern Andhra Pradesh (van der Maeson 1985; Fuller 2002: 295). Several gourd types (family Cucurbitaceae) are native to the northern half of India (Walters 1989; Decker-Walters 1999), including this region, although separating a realistic wild distribution rather than the spread of weedy forms associated with escapes from cultivation remains problematic. The case of tuber crops, such as taro (*Colocasia esculenta*) and various yams (*Dioscorea* spp.), which remain important in parts of Orissa, requires further research, although the cultivated forms of these species found today could be largely introductions from Southeast Asia.

In addition to the possibility of local domestication there is clear evidence for the introduction of domesticates from elsewhere. This is most obviously the case with domestic fauna such as sheep and goats, but may also be true of domesticated forms of cattle and water buffalo. Wheat, barley, and pulses of winter seasonality and Near Eastern origin are largely absent from the region today. That some input into the subsistence systems came from further east (Southeast Asia) is suggested by the presence of Munda-speaking groups (e.g. the Santals, Mandari, Bhumji, Juangs, Khoria), who are linguistically related to the diverse Austro-Asiatic language family located mainly in Southeastern Asia, including the states of Northeastern India. Linguistic attempts to reconstruct their earlier vocabulary suggests that they may have arrived with domestic animals (perhaps water buffalo and pigs) and perhaps some crops (whether they were rice cultivators remains controversial), but many other crops that reconstruct proto-Munda are likely loans from other groups in India (cf. Zide and Zide 1976; Fuller 2003b). On the basis of probable loanwords from Dravidian languages relating to native peninsular crops, such as horsegram (*Macrotyloma uniflorum*) and possibly a small millet term, it has been speculated that contact between Dravidian speakers and intrusive Munda agriculturalists might have occurred in the early second millennium B.C., and thus during the later Neolithic (Fuller 2003b). What is needed first and foremost to move beyond speculation is hard evidence, collected systematically, about the bases of food production in the region.

Orissa is one of the most poorly studied areas of India in terms of archaeological investigations and in particular agricultural origins. Few excavations have taken place in this state and there is a complete lack of archaeobotanical sampling and flotation. This is not the result of a deficiency in archaeological remains as Orissa appears to have abundant archaeological sites of all periods (Basa and Mohanty 2000; Sengupta and Panja 2002) and therefore, offers the potential for new investigations into the prehistory of this area. The only well known multiphase site in Orissa, showing the transition from a Mesolithic to Neolithic community, is Kuchai in Mayurbhanj (IAR 1961-62: 36; Thapar 1978; Basa 1997). This site has been reported to have rice remains and also wild rice impressions in the ceramics (Vishnu-Mittre 1974, 1976) but no systematic sampling was conducted. We report the first results from a research program aimed at building up a picture of early agriculture across the region. This can be achieved in the first instance through field exploration, limited section scrapings or excavations and the collection of archaeobotanical evidence, following the principles that have proved successful in recent investigations of Southern Neolithic subsistence (Fuller *et al.* 2001a; 2001b; 2004; Korisettar *et al.* 2001; Fuller 2003a).

Methods

Fieldwork in Orissa was conducted in September-October 2003 by the Indian authors and this produced samples from a number of sites with long temporal sequences and also short lived semi-sedentary sites (Fig. 1). Sites were selected that had been previously excavated or surveyed by the Indian collaborators and were thought to have the potential to recover archaeological plant remains, especially through the cleaning of exposed or eroding sections. Two lowland sites in South Orissa, Gopalpur (GPR) and Golbai Sasan (GBSN), have been previously explored and the latter excavated but no archaeobotanical sampling took place (Sinha 1993, 2000; Mohanty 1994; Kar 1995, 2000; Kar *et al.* 1998). These sites are both extensive mounds with cultural sequences spanning the Neolithic through to the Iron Age. Therefore, systematic sampling was conducted at both of these sites by exposing a clean section at the side of the mounds by the Indian authors. Bulk samples (20 L) and phytolith samples were taken from all the stratigraphic layers (see Figs. 3-4). Sampling at Gopalpur was hindered by a high water table, which prevented some of the lower levels being sampled but Neolithic deposits were still sampled.

In the Central and Northern highlands of Orissa, a number of sites were sampled but none of these had long sequences and probably represented more short lived sites or seasonal camps. The sites sampled were Bajpur,

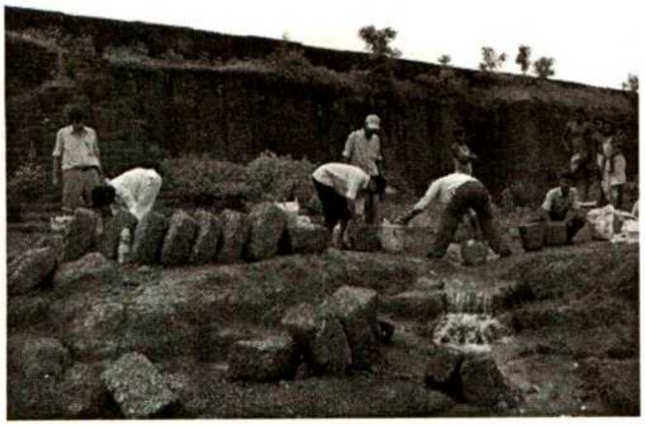

Fig. 2: Simple bucket flotation in Orissa

Malakhoja, and Banabasa. Malakhoja was sampled from an exposed section as described above. Sampling was conducted at the other two sites by digging 1 x 1 m test pits and taking samples (20 L bulk samples and phytolith samples) every 10 cm until sterile deposits were reached.

Samples were processed using simple bucket flotation, in particular the wash-over method (Fig. 2). This consisted of adding filtered water to the sediment in a bucket, mixing, and then pouring into a 500 micron sieve bag to collect the flot. Once all the flot has been collected the heavy fraction left in the bucket is passed through a 2 mm sieve to retrieve any artefacts and heavy environmental remains. The flotation samples consisting of charcoal and charred seeds were sorted between x 6 and x 40 under a binocular microscope. Identification of Indian plant species is not always straightforward and therefore the millets and pulses were identified using the criteria developed by Fuller (1999) and also see discussion in Fuller *et al.* (2004) and for pulses Fuller and Harvey (in press). Distinguishing between wild and domestic species of rice is also problematic and has not been attempted at this stage. Part of this project is to carry out a study comparing macroscopic and microscopic morphometric identification methods for rice and therefore more refined identifications can be presented once this study is completed.

Lowland Sites: Gopalpur and Golbai Sasan

Prehistoric settlements in the coastal alluvial plain of Orissa seem to have been established by the 3rd millennium B.C. and are located close to Chilka Lake and the Mahanadi delta, which feeds into it (Misra 2002). These sites are substantial mounds with continuous sequences from the Neolithic through to the Iron Age (1st millennium B.C.). Three of these sites have been explored previously: Golbai Sasan (Sinha 1993, 2000; Mohanty 1994), Gopalpur (Kar 1995, 2000; Kar *et al.* 1998), and Khameswaripalli (Behera 2002). These sites have produced extensive ceramic assemblages, animal bones, and when excavated bone tool assemblages (Sinha 2000; Behera 2001), including projectile and harpoon points, which suggests some importance for fishing. Golbai Sasan is the most extensively excavated of these sites and therefore offers the best evidence of early farming settlements in this area (Fig. 3). This site has the only radiocarbon date recorded for this area and the beginning of the Chalcolithic deposits are dated to 4100 ± 100 BP (PRL 1637, 2300-2100 cal B.C.). The site is located on the left bank of the river Mandakini a tributary of the Daya River, which flows into Chilka Lake.

The excavators have recognised three distinct periods: Neolithic, Chalcolithic, and Iron Age. The Neolithic horizon contained evidence of structures, a handmade pottery assemblage of coarse red and grey wares with cord and reed impressions, and bone tools but no stone tools. After this period new technologies are found, such as stone tools, copper tools, and different pottery wares, which led to the suggestion of an influx of people (Sinha 2000). Previously recovered bio-archaeological remains suggest a subsistence pattern consisting of rice and pulse

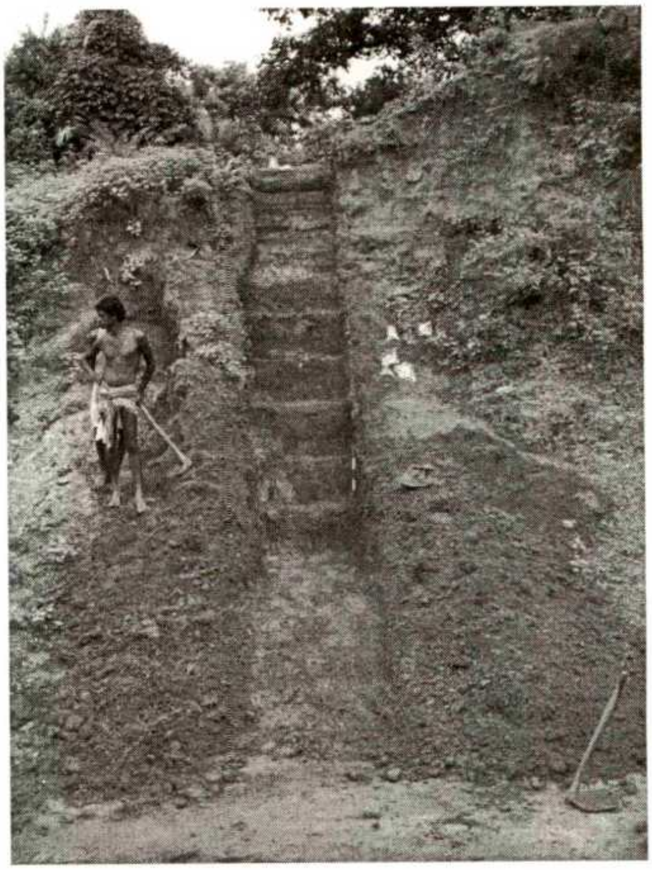

Fig. 3: Sampled section at Golbai Sasan

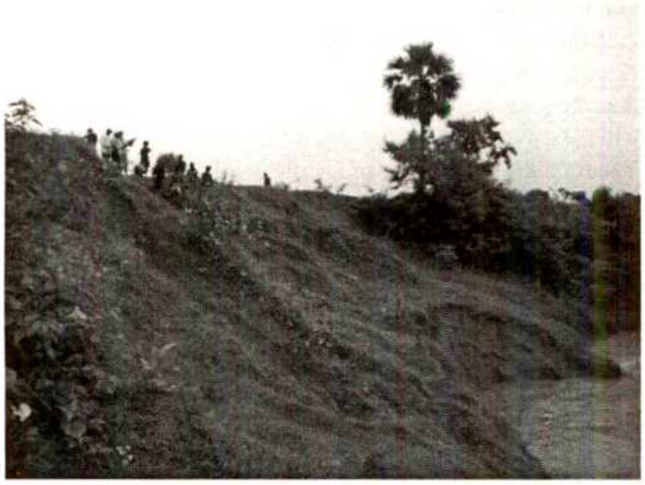

Fig. 4: Gopalpur, Orissa

(horsegram) agriculture, domestic animals, hunting, and fishing. The last period is seen as a continuation of the previous period but with the addition of iron artefacts.

Although excavations have not taken place at Gopalpur (Fig. 4), this site is considered to have an affinity with Golbai Sasan. However, Golbai Sasan (200 x 200 x 11 m representing length, width, height) is a somewhat larger sized mound than the mound at Gopalpur (140 x 115 x 9 m). From surface explorations, similar pottery to that found at Golbai Sasan was recovered including the earlier red and grey wares, and the subsequent black and red wares associated with the Chalcolithic. There is less evidence of a rich bone tool industry but bones of domestic as well as wild animals were found. No surface bone finds appear to be sheep and goat. This may suggest they were adopted later then cattle. No plant remains have been reported from Gopalpur and therefore inferences could not be made concerning agricultural activities of these people prior to the current investigations.

Preliminary Archaeobotanical Results

Flotation samples (29 samples) from Gopalpur and Golbai Sasan have been sorted and identified (Table 2 and 3). These samples offer the main bulk of data for macro-remains collected from this region but only represent the coastal sedentary tradition. At present, no phytolith samples have been processed or analysed and therefore this data can not be presented here but will hopefully add a great deal to the overall knowledge of the economy of this region.

The macro-remains found at Gopalpur and Golbai Sasan are similar in content and are evidence of the economy of the sedentary prehistoric settlements of the Orissan lowlands (coastal plain). The main crop plants represented at these sites are rice and a number of pulses including horsegram (*Macrotyloma uniflorum*), pigeon pea (*Cajanus cajan*) mung (*Vigna radiata*), and urd (*Vigna mungo.*). Millets are also present (*Panicum sumatrense, Paspalum* sp., and *Setaria* sp.) but are all small varieties likely to be weeds of the rice crop rather than exploited as crops as is the grass *Ischaemum cf. rugosum* (Fig. 5).

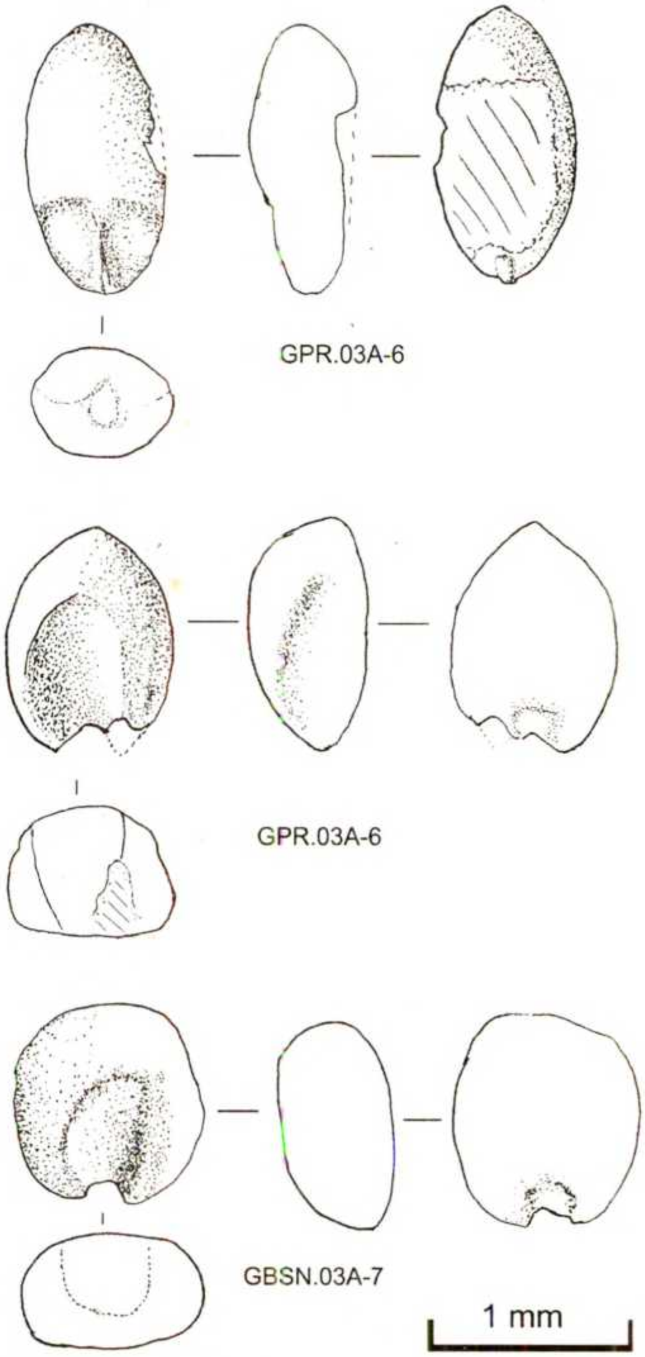

Fig. 5: Representative specimens of recurrent millet grasses of the Orissan Neolithic. These species are all probable weeds of rice. Top: cf. *Ischaemum rugosum*; Middle: *Panicum sumatrense*; Bottom: *Setaria* sp.

Table 2: Crop plants from Golbai Sasan

Sample Golbai Sasan	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Vigna sp. (whole)	2														
Vigna sp. (cotyledon)	30					2		2	4			2	2	1	
Vigna sp. (frag)	43							5			2		1		
Vigna cf. mungo (cotyledon)	3														
Vigna cf. radiata cotyledon)	5														
Vigna cf. radiata (whole)	2														
Macrotyloma (whole)			1												
Macrotyloma (cotyledon)						3	1	1	5		1				
Macrotyloma (frag)						6			3				2		
Cajanus (whole)						1									
Cajanus (cotyledon)	1					2	1								
Cajanus (frag)															
Cajanus/ Lablab?															
Pulse frags	76	6		3	4	13	29	23	24	8	11	17	9	3	4
Panicum sumatrense															
Setaria sp.							1	1		1				1	
Panicum sp.						1									
Paspalum sp.										1				3	
Indet. millets									3						
Oryza sp. (whole caryopsis)	1					3		3	1	1			3	2	2
Oryza sp. (caryopsis frags)	14	15	5	6	7	102	33	35	42	4	15	9	11	18	34
Indet. Graminae (caryopsis)	2	2				24	12	7	14		2		5		2
Ziziphus sp.						1	2	5							
Fruit stone unidentified						54	2		5		1	1	9		16
Weeds seeds						20	16		2	7	6	6	7	3	7
Charcoal	xx	xx	xx	x	x	xxx	xx	xx	xx	x	xx	x	xx		
Unknowns	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Total fragments	179	23	6	9	11	232	98	82	102	21	38	35	49	31	65

Key: Y = present, x = rare, xx = common, xxx = abundant.

1 GBSN-03A- 3 2 GBSN-03A-5 3 GBSN-03A-7A 4 GBSN-03A-7B 5 GBSN-03A-8 6 GBSN-03A-9 7 GBSN-03A-10 8 GBSN-03A-11
9 GBSN-03A-12 10 GBSN-03A-13A 11 GBSN-03A-13B 12 GBSN-03A-13C 13 GBSN-03A-13D 14 GBSN-03A-14A 15 GBSN-03A-14B

Table 3: Crop plants from Gopalpur

Sample Gopalpur	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Vigna sp. (whole)														
Vigna sp. (cotyledon)														
Vigna sp. (frag)														
Vigna cf. radiata														
Macrotyloma (whole)		8	8			1	1							
Macrotyloma (cotyledon)		19	10			1	1							
Macrotyloma (frag)		38	73			10	8	2	1					
Cajanus (whole)														
Cajanus (cotyledon)		2												
Cajanus (frag)														
Cajanus/ Lablab?														
Pulse frags	37	85	156	3	3	27	12	6	5	2	1			
Panicum sumatrense				1				1						
Setaria sp.							3	1						
Panicum sp.						8								
Paspalum sp.														
Echinochloa						1								
Indet. millets								2			1			
Oryza sp. (whole caryopsis)								2						
Oryza sp. (caryopsis frags)	3	1	5	3	3	23	11	18	4	6	18	5	9	
Indet. Graminae (caryopsis)						1								
Ziziphus sp.												1		
Weeds seeds	2	28	18	4		13	3	9		1	4	1		1
Charcoal	xx	xxx	xx		xx	xx	xx		x	x	xx	xx	x	x
Shoots		Y												
Unknowns	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Total fragments	42	181	270	11	6	85	39	41	10	9	24	7	9	1

1 GPR-03A-1 2 GPR-03A-2 3 GPR-03A-3 4 GPR-03A-4 5 GPR-03A-5 6 GPR-03A-6 7 GPR-03A-7 8 GPR-03A-8
9 GPR-03A-9 10 GPR-03A-10 11 GPR-03A-11 12 GPR-03A-12 13 GPR-03A-13 14 GPR-03A-15

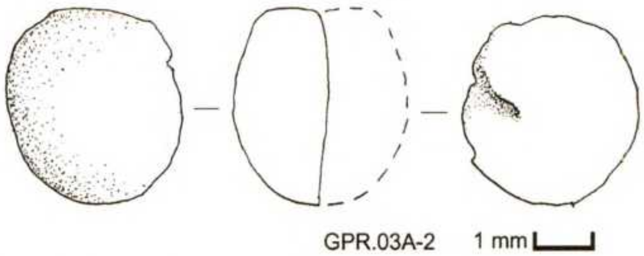

Fig. 6: Drawing of cotyledon of *Cajanus cajan*, from Golpalpur, sample level 2 (Neolithic)

Crops are present in the earliest levels sampled at each site. However, there are differences that may suggest more variation between these sites than previously thought.

The plant assemblages from Gopalpur are dominated by pulses and particularly Horsegram. Although, urd and mung are not present at this site. The richest samples at Gopalpur are found at the bottom of the sampled sequence and suggest that, as thought, the bottom of the deposits was not reached. Two *Cajanus cajan* cotyledons are present in sample 2 (Neolithic level) from Gopalpur and may represent the earliest find yet of this species in India (Fig. 6). This crop is likely to have originated in this region as the wild progenitor is only present today in South Orissa and Bastar. Thus the present find indicates that the cultivation of this species had begun by the mid-third millennium B.C. This crop has been found in a number of sites in South India in 2nd millennium B.C. deposits.

Rice dominates the samples from Golbai Sasan and there are also a substantial number of pulses (Horsegram, urd, mung, and pigeon pea). Small millets and fruit stone fragments (some being Indian jujube, *Ziziphus mauretania*) are also present in the samples.

This area of Orissa shows similarities to the archaeobotanical remains found at the Vindhyas culture sites in the Belan River Valley (Harvey *et al.* 2005). Both areas exploit rice, small millets, and native pulses, all of which are indigenous crops to India. There are also similarities with sites in Gujarat, which have been suggested to cultivate native pulses (*Macrotyloma uniflorum* and *Vigna mungo*) and small millets (*Panicum sumatrense*) from the fourth millennium B.C. but do not have definite evidence for rice cultivation (Weber 1991; Fuller 2002, 2003a). The Southern Neolithic is initially based on a native crop package similar to that found in Orissa; two small millets (*Bracharia ramosa* and *Setaria verticillata*) and two pulses (again *Macrotyloma uniflorum* and *Vigna radiata*). This is followed by the introduction of non-native taxa such as wheat, barley, possibly rice, Hyacinth bean, African pearl millet, and pigeonpea (presumably from the southern Orissa region) (Fuller *et al.* 2004). While this clearly supports the idea of independent plant domestications in India, this raises the question of where and when these native species were domesticated. Does this indicate multiple areas of domestication of the native pulses and small millets in India or are we seeing domestication in a certain region which then spread? Establishing a clear chronology for the appearance of these crops will enable these questions to be addressed further.

Upland Sites: Bajpur, Banabasa, Malakhoja

In the highlands of Orissa, a difference in the archaeological sites is apparent. They appear to be more ephemeral and therefore do not have the depth of deposits found in the coastal lowlands. Some highland sites near Chilka Lake have been suggested as being Mesolithic hunter-gatherer sites from microlithic finds, which may represent the people who later moved to the lowland sedentary sites (Misra 2002). However in North Orissa, these ephemeral sites are probably more contemporaneous with the settled farming societies in the lowlands and may represent a subsistence choice of shifting cultivation or more mobile people with seasonal camps. Shifting cultivators still exist today in the North Orissan Highlands and areas of adjacent states (Mohanty 1998, Pratap 2000) and therefore suggest a different pathway for prehistoric people to the settled life of the lowlands.

Bajpur is situated on the left side of the National Highway, 6 towards Keonjhar and 1 km from Pallahara College (Fig. 7). The original excavations exposed an area of about 200 sq. m and contained surface finds of finished and unfinished axes, chisels, flakes, chips, and potsherds (Basa *et al.* 2000, Mohanta 2002). Previous trial trenches revealed little organic remains except a small amount of charcoal. The site consists of three layers with a total depth of approximately 0.85 m. There are two Neolithic levels preceded by an underlying Mesolithic level.

Fig. 7: Sampling at Bajpur

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Environmental samples were taken from an area not under cultivation down to 50 cm and therefore the site was sampled down to the Mesolithic deposit. Rice cultivation has encroached extensively on the site including the central part where earlier observations were made.

The site of Banabasa is a small hillock close to the left bank of the river Khairi in Mayurbhanj, North Orissa and was found by Mohanta (2002). There are three distinct locations at the site covering an area of 125 x 27 sq.m. Banabasa 2 was sampled for environmental remains because it was thought to have the greatest depth of deposit; up to 50 cm at the most. Lithic scatters are found on the surface including axes, adzes, chisels, and microliths. The site of Kuchai unfortunately has been put under cultivation and is now flattened. Therefore, no environmental sampling could take place at this site.

The site of Malakhoja is located close to the reported site of Sankerjang (Yule and Rath 2000). At Sankerjang, there are number of mounds, which contained burials dating to the late Neolithic/Early Chalcolithic period. However, Malakhoja is probably later in date and does not have the same depth of deposit as Sankerjang. A number of environmental samples were taken from this site and are in the process of being analysed.

Archaeobotanical analysis has not been fully completed but initial analysis demonstrated little organic remains corresponding with the suggested short-lived nature of the sites. Hence, two different trajectories are apparent at the same time in Orissa; a move to settled agricultural life in the lowlands and a more mobile life incorporating shifting cultivation or seasonal mobility in the highlands.

Discussion: Characterising Two Neolithic Traditions in Orissa

We now have the first firm evidence for considering the origins of agriculture in Orissa. As a working hypothesis, one can suggest two quite different Neolithic traditions, one associated with the coastal plain and major river valleys and another in the foothills and uplands, often in what are traditionally considered tribal areas. The Neolithic of coastal Orissa (which we might call the Eastern Wetland Tradition) is represented by some impressive mound sites, with well-stratified and substantial sequences that begin sometime in the early third millennium B.C. and continue into the Iron Age (early first Millennium B.C.), as at Golbai Sasan, Gopalpur, and probably also Khameswaripalli (Behera 2002). The harpoon points as well as the environmental context of these sites (on perennial streams and rivers in the wet lowlands), suggests the likelihood that fishing was a significant part of the economy, in addition to animal husbandry (Kar 2000) and cultivation. Whether the full complement of sheep, goat, cattle, and water buffalo were present from the beginning of this tradition requires clarification from systematic faunal sampling and reporting, although the apparent absence of sheep and goat from the surface bone assemblage of Golpalpur could hint at a more interesting process of gradual livestock adoption (cf. Kar 2000). As discussions of the artefacts have indicated there is a general affinity between the ceramic and bone tool assemblage of these Orissan sites and those of Chirand in the Ganges valley of Bihar (Sinha 2000; Dash 2000). It is indeed conceivable that these sites are all connected as part of a rapidly dispersing subsistence culture, based on fishing, domestic fauna, and rice-pulse agriculture. However, as the archaeobotanical evidence now indicates, there is a rather different tradition to that found at Chirand, which has winter crops of western origin. The introduction of wheat, barley, lentils, and peas into Chirand (Vishnu-Mittre 1974, 1976) does not appear to have continued to the Orissan lowlands. What does this tell us about the contact between these two areas; was it just an exchange of material culture, a conscious choice not to adopt these new crops into the predominantly wet areas of Orissa, or was there no contact at all between these two areas?

As for the upland Orissan Neolithic, small-scale excavation and flotation seem unable to shed light on early agriculture. These sites appear to be largely superficial with little depth of deposit, nor clear archaeological strata and sparse find densities, including the absence or very low presence of any charcoal. What this pattern suggests is a very different nature of site occupation, of shorter longevity and/or longer lapses between occupation episodes. Either we are dealing with seasonally occupied sites, perhaps for special activities such as lithic/celt manufacture, or the loci of settlements of shifting cultivators, or both. The absence of any more substantial sites and pottery points to a much less sedentary tradition, and one wonders whether the absence of pottery might also suggest an emphasis on crops like tubers, which can be readily pit-roasted, rather than seed crops. Pratap's (2000) model of shifting cultivation in the Rajmahal Hills offers some comparison to the kind of evidence found by us in the northern Orissan uplands.

This study has only just touched the surface of Orissan prehistory and much more work is needed to form a detailed picture of the economic strategies of these peoples. Future work will concentrate on phytolith analysis on the sampled sites, and landscape investigations including geoarchaeology and pollen coring to explore the prehistoric environment of this region in more detail. The macro-botanical material recovered so far will also be put forward for radiocarbon dating so that a chronology can be built of the sites. Therefore, the introduction of crop species in this area can be fitted into the larger framework of Indian prehistory and the suggestions of pristine domestications can be confirmed.

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Settlement Pattern of the Predecessors of the Early Harappans at Bhirrana, District Fatehabad, Haryana

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Abstract

The discovery of the Hakra ware settlements in the Cholistan region of Pakistan, and their stratigraphic occurrence below the Kot Dijian phase at Jalilpur near Multan, enables one to situate the Hakra ware cultures as being predecessors of the Early Harappans. In India, Hakra wares are reported to be associated with wares of the Early Harappan period as noted at excavations at Kalibangan, Banawali, Rakhigarhi and Kunal. The Bhirrana excavation has revealed, for the first time, an independent stratigraphic existence of the Hakra wares deposit underlying that of the Early Harappan. This paper deals with the settlement pattern and the other related aspects of the Hakra wares culture.

Introduction

The excavation of the Harappan mound at Bhirrana (29° 33' N; 75° 33' E), during the field seasons of 2003-04 and 2004-05 has revealed for the first time in India, a continuous four-fold cultural sequence of the Harappan civilisation (Table 1) (Rao *et al.* 2005). This paper deals with the settlement pattern and other related aspects of the Hakra Ware Culture, which was not only the immediate predecessor of the succeeding Early Harappan; but also the first cultural phase at Bhirrana. The excavation has shown that these early inhabitants initially occupied the left bank of the currently dry course of the river Saraswati, where the meander (running from northeast to southwest with its thrust towards the north), provided a safe occupation zone. Interestingly, these early inhabitants preferred to live in subterranean shallow circular pits dug directly into natural soil. On the slopes of the northern periphery of the main mound, a cluster of such pits of different dimensions was excavated falling within the trenches ZD10, ZD11, ZE10 and ZE11. (Fig. 1-3). However, this area did not yield any overlying cultural deposits of subsequent periods. As such, these pits directly opened out to the sky. Besides this, similar dwelling pits cut into natural soil and now lying underneath the base of the main mound were also found in trenches A1, B1 and YH5. However, these pits were partially exposed. A few more pits were noticed in trenches XH1 and XJ1 on the western periphery of the mound, and are yet to be excavated. Thus it is clear that the early inhabitants occupied a large area covering the northern, central and western part of the mound. Irrespective of the location of the trenches all excavated dwelling pits were given progressive numbers for the sake of convenience.

Table 1: Cultural sequence at Bhirrana

Period IA	Hakra Wares Culture
Period IB	Early Harappan Culture
Period IIA	Early Mature Harappan Culture
Period IIB	Mature Harappan Culture.

In general, these pits are found in clusters and are circular in shape. They are of different dimensions and were used for different purposes as indicated by the nature of material remains retrieved from them. Dwelling pits are shallow and vary in depth from 34 to 58 cm; while the diameter varies from 230 to 340 cm (Table 2). The walls and floors of these pits are plastered with yellowish alluvium. Such pits appear to be sufficient to accommodate 3 to 4 persons. Surrounding these dwelling pits, other auxiliary pits, smaller in diameter ranging from 200 to 230 cm and 80 to 108 cm in depth, served different purposes such as for sacrificial/kitchen/industrial activities, and to dump refuse.

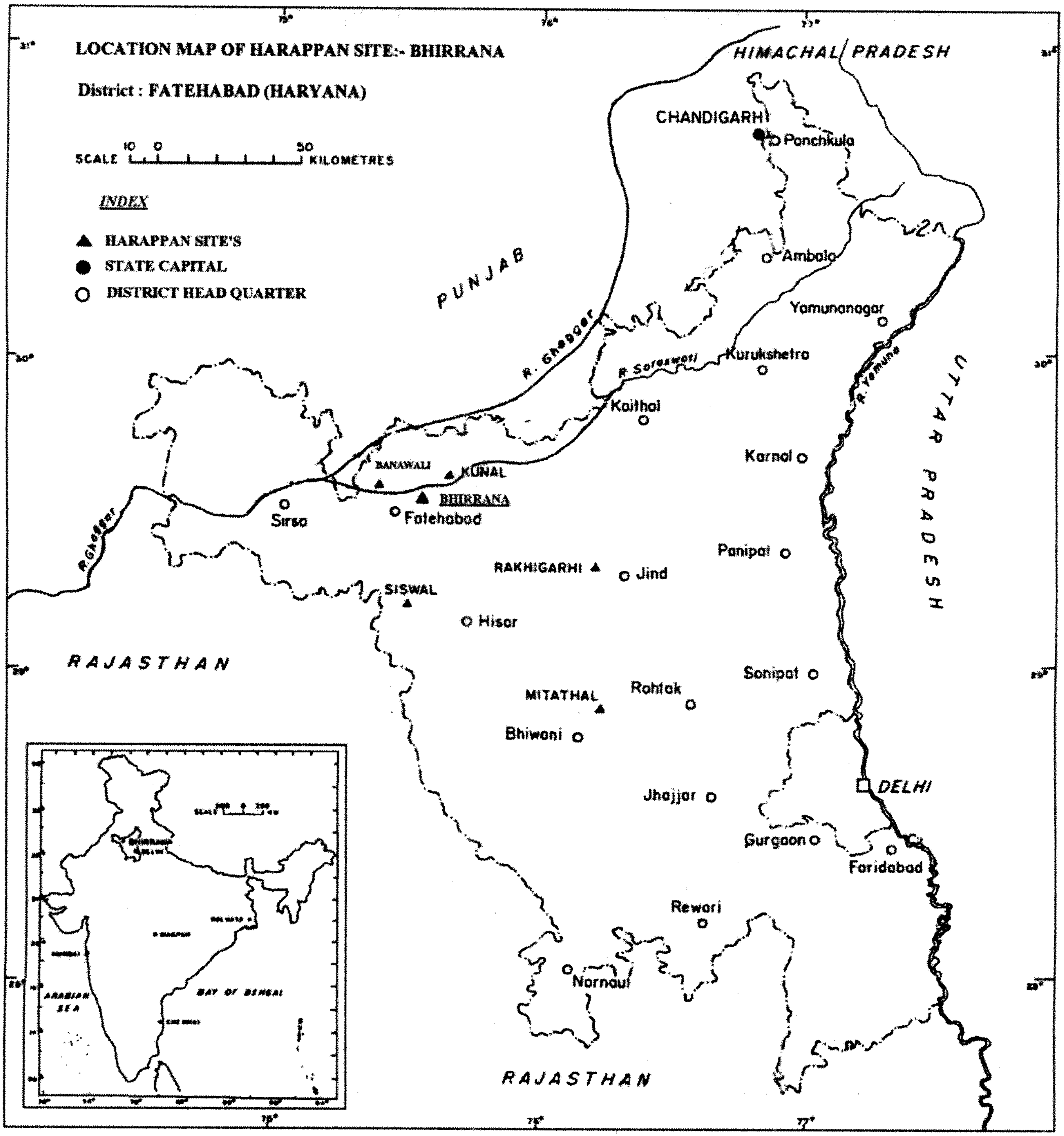

Fig. 1: Map showing the location of Bhirrana

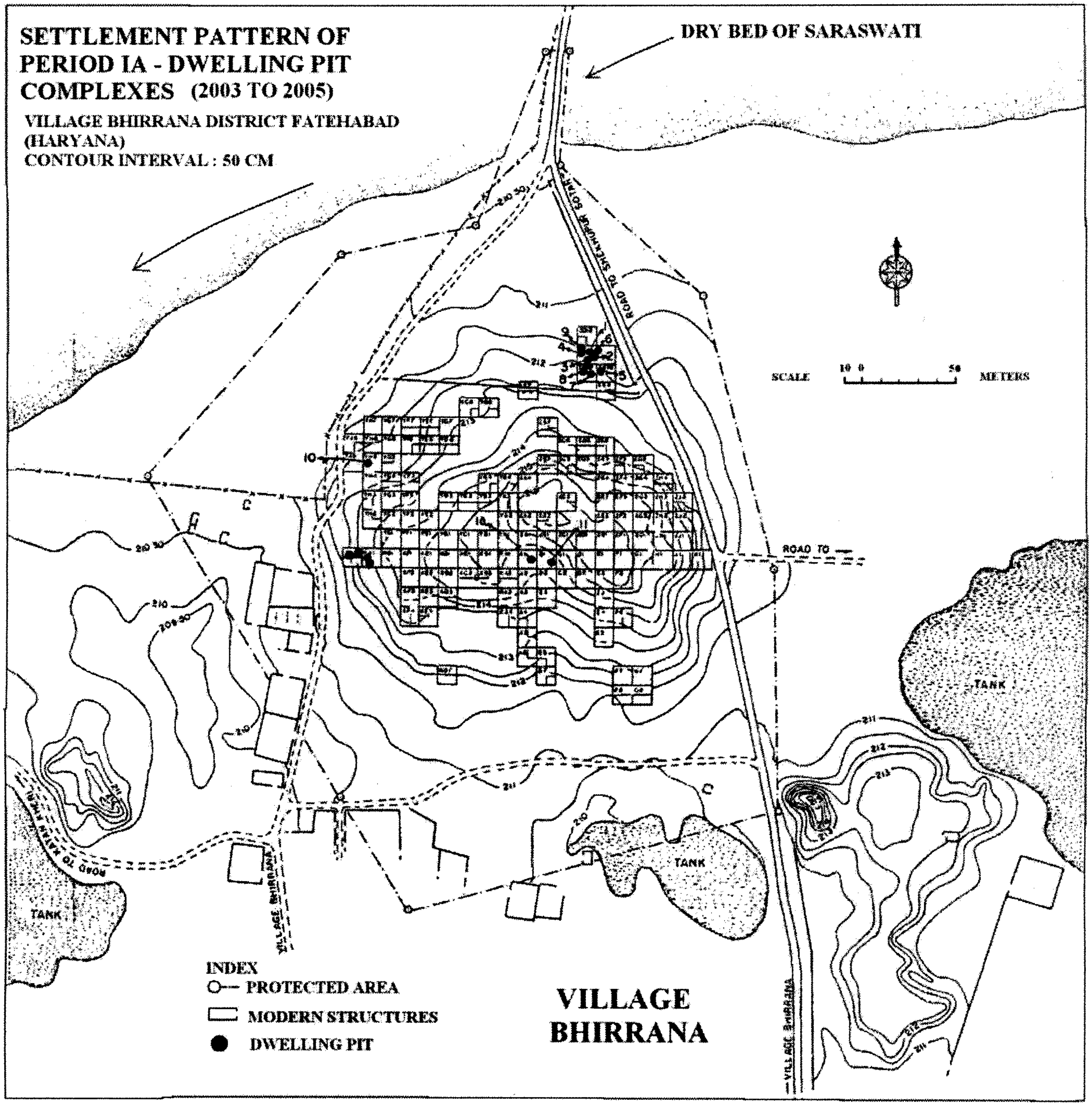

Fig. 2: Contour map showing location of dwelling pit complexes (©ASI)

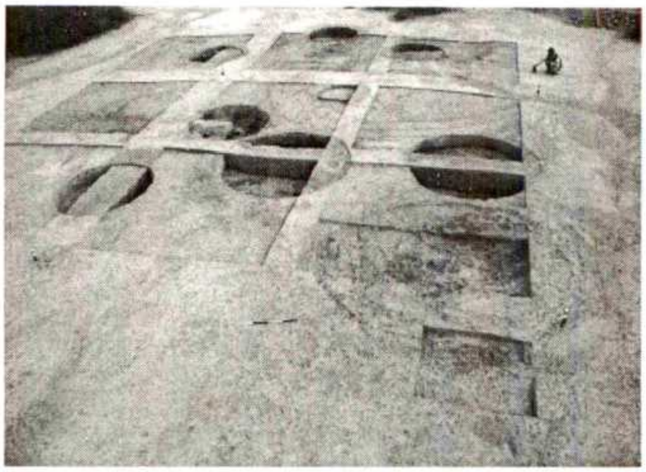

Fig. 3: General view of an excavated dwelling pit complex (©ASI)

Table 2: Details of the dwelling pits

Location	Pit No.	Nature	Diameter and depth in cm
Tr.A1/ III	1a sealed by 7	dwelling pit	122 x 80 (extant)
Tr. ZD11/II and III	1 open to sky	dwelling pit	340 x 50
Tr. ZD11/III	2 open to sky	dwelling pit	230 x 34
Tr. ZD11/ III	3 open to sky	refuse pit	156 x 13
Tr. ZD11/I	4 open to sky	dwelling pit	312 x 56
Tr. ZE 10/I	5 open to sky	sacrificial/Kitchen/Industrial	230 x 108
Tr. ZE11/I	6 open to sky	dwelling pit	226 x 58
Tr. ZE10/II	7 open to sky	sacrificial/Kitchen/Industrial	200 x 85
Tr. ZD10/I	8 open to sky	sacrificial/Kitchen	200 x 80
Tr. ZD11/I	9 open to sky	refuse pit of Mature Harappan	Not completely excavated.
Tr. YH5/I	10 sealed by 5	dwelling pit	32 (extant depth)
Tr. B1/ III	11 sealed by 15	dwelling pit	200 x 30 (extant)
Tr. B1/III		circular, rammed and mud plastered floor built over ground	Extant diameter: 200

Dwelling Pits Nos. 1-2, 4, 6, 10 and 11 (Table 3)

The nature of cultural deposits in these shallow dwelling pits was invariably loose soil mixed with a small quantity of ash. The first floor level at the bottom of dwelling pit 1 had a burnt patch with ash deposits, not seen in any other pit.

Sacrificial/ Kitchen/ Industrial pits 5, 7 and 8 (Table 4)

These auxiliary pits were perhaps multipurpose, as seen in the nature of the cultural deposit. All three pits had invariably loose soil deposits containing quantities of ash and pieces of charcoal. The cross-section of these pits clearly shows different working levels with a regular accumulation of cultural deposits over a period of time.

Table 3: The material remains recovered from the *dwelling pits 1-2, 4, 6, 10 and 11*

Dwelling Pit No.	Material remains
1	A few potsherds, a few charred bones and sun baked spherical clay lumps.
2	A few potsherds and charred bones
4	Potsherds, charred bones, fragments of terracotta bangles, globular carnelian pendant and raw material, black agate bead, terracotta marble, lapis lazuli beads.
6	Potsherds, charred bones, sun baked spherical clay lumps, fragments of terracotta bangles, fragment of a parallel sided chert blade, hopscotch made on pottery, unfinished animal figurine (?) and fragment of a polished bone point.
1a, 10 and 11	Except pottery, no antiquities were recovered.

Table 4: The material remains recovered from the dwelling pits Nos. 5, 7 and 8

Pit No.	Material remains
5	Potsherds, charred bones including a bovine skull with horns, crucible fragments, slag, terracotta bangle fragments, terracotta broken bead, burnt clay lumps of wattle and daub, sun baked spherical clay lumps, sandstone sling ball, quartzite pounder/rubber, sandstone pestle, terracotta net sinker.
7	Potsherds, charred bones including a bovine skull with horns bearing cut butt ends, crucible fragments, sun baked spherical clay lumps, sandstone sling balls, fragment of a rectangular sun baked clay cake with nail incisions, fragment of a sun baked faceted clay object with thumb impression and a perforation and terracotta bangle fragments
8	Potsherds, charred bones and terracotta bangle fragments.

These pits could have served as kitchens as reflected in the large quantity of charred bones recovered. However, the occurrence of a bovine charred skull with horns having cut butt ends, along with other bone fragments on the first floor at the bottom of pit 7 (Fig. 4) and bovine skull with a short horn and other bones lying about 20 cm above the first floor at the bottom of pit 5, may relate to ritualistic practices involving animal sacrifice. The pits were also used for melting copper as attested to by the recovery of fragments of crucibles of different shapes and sizes from the early levels of pits 5 and 7. Molten specks of copper can be seen sticking to the inner sides of crucible fragments (Fig. 5).

Pit 3 appears to be the smallest and might have served as a refuse pit, as it yielded a few potsherds and bone fragments. On the other hand, pit 9, which has not been completely excavated till date, is a huge refuse pit containing a large quantity of pottery and other antiquarian remains of the Mature Harappan period.

An exceptional feature of these dwelling pits is the absence of postholes surrounding them. Surface clearance of the area around pits 1 to 9 has shown that all pits have a light to dark ashy cover on the top which in itself is very suggestive. In fact, these pits had a humble superstructure of wattle and daub. At some stage, this superstructure was possibly burnt leaving behind an ashy cover and other residual remains, as confirmed by the presence of burnt clay lumps with reed marks recovered from pit 5.

As is evident from available but limited information from trench B1, these pit dwellers in course of time, abandoned the use of subterranean dwelling pits and chose to live above the ground. This is supported by the presence of a partly exposed circular mud plastered rammed floor with a *chullah* by its side (Fig. 6). Incidentally this rammed floor rests just above dwelling pit 11. This point still requires further investigation. From now onwards, human activities above ground contributed to the formation of a regular stratified habitation deposit. This process is amply

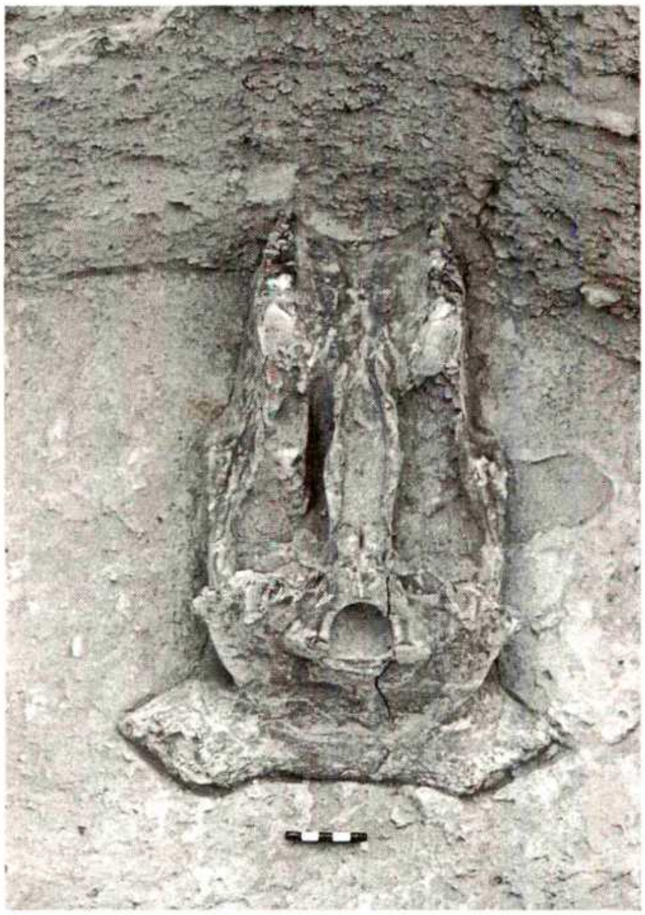

Fig. 4: Close-up of a charred bovine skull in pit 7 (©ASI)

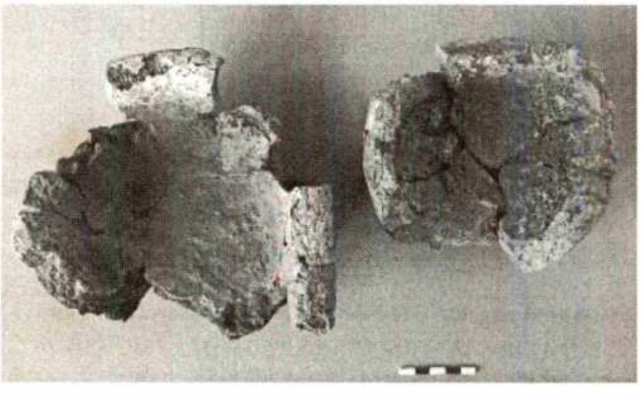

Fig. 5: Crucibles (©ASI)

clear from the cultural deposits exposed at the lower levels of trenches A1 and B1, with a maximum deposit of 145 cm exclusively belonging to the Hakra Wares period.

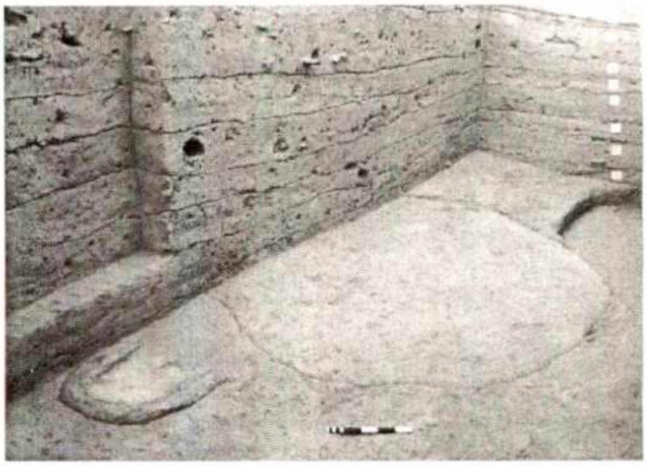

Fig. 6: Circular rammed floor and *Chullah* (©ASI)

Apart from the usual pottery of the period, important antiquities recovered from strata lying above ground level of Period IA, were a sandstone rubber, a sandstone marble, finely polished bone points, fragments of terracotta bangles, a damaged terracotta *idli* shaped cake with a thumb impression, and a faceted terracotta rubber/burnisher.

Ceramics

A noteworthy feature of this period is the fact that ceramics recovered from the pits are very similar in shape, fabric and surface treatment to "Hakra Wares" as reported by Mughal (1997) from the Hakra river basins in Cholistan. However, some differences were observed which may be interpreted as regional variations. The Hakra ware repertoire at Bhirrana occurs in a separate horizon without any intrusion of any type of novelty.

(i) Mud Appliqué Ware

Pottery in this category is usually represented by medium to thin-bodied wheel made pots. The mud is heavy and in some cases is directly applied onto the surface of the pot. The entire body of the pot is interspersed with white quartz granules. The appliqué in some cases is on the entire exterior surface below the neck, while in other cases it occurs up to the belly. Though often made on a slow wheel, the pots are not well finished and the surface colour varies from dull red to grey. The rims are often painted with a band externally as well as internally. The usual shapes in this category are globular pots and heavy bodied storage jars. Heavy-bodied storage jars have a thick mud coating and are hand made, whereas thin to medium bodied globular pots have thinner coatings and are wheel made. The latter type predominates at Bhirrana. The rims are simple, rounded, everted and at times slightly out turned. The firing is usually not good. This variety continues in a slightly modified version in the upper levels. However the surface colour changes to bright red and the appliqué design looks more like rustication.

(ii) Incised Ware

Two distinct categories of incised ware were seen at Bhirrana in the Hakra repertoire. Though distinctly different from each other they had a few common features. Incisions were executed on the vessels directly without any slip. The surfaces were at times smoothened or left undulating. The vessels are wheel made on a slow wheel and are well fired. The incisions were executed from the shoulder level while the neck and the rim were covered with a broad black band. Handled pots (jugs) were common in both categories. The two categories mainly differed as one was deeply incised on the exterior while the other had light incisions. Shapes having everted and rounded rims represented both categories.

Deep Incised Ware

This was often red to bright red in appearance without any slip. Pre-firing incisions, with a sharpened reed or similar object, were executed from shoulder to belly. The incisions were usually bound by black bands on either side. The patterns were usually rows of chevrons and criss-crosses. The usual shapes were small vases, handled vases (jugs?) and *lota* like vessels (Fig. 7).

Light Incised Ware

Ceramics belonging to this category were usually small vases, handled vases (jugs) and *lota* shaped vases. The incisions were mainly wavy lines executed probably with a comb like object. The incisions were directly executed on the surface between the shoulder and belly, without any slip. They were generally confined within two or three incised parallel lines.

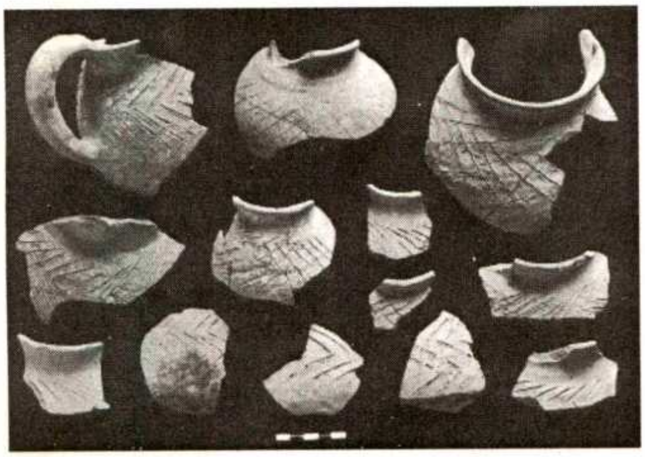

Fig. 7: Deep Incised wares (©ASI)

(iii) Tan Slipped/Chocolate Slipped Ware

This type of pottery occurred at the site right from the inception till the end of the occupation. However, a few variations in texture were seen. These wares were well fired having medium to fine fabric. Tan or chocolate slip was applied from the rim to the base, though in some cases it covered only the neck, while in other cases, extended up to the belly. When the slip existed only along the neck, there was no internal rim band, whereas other varieties with slip up to the belly and base were invariably decorated with rim bands and sometimes with vertical strokes emanating on the internal side of the rim. Globular pots with everted rims were the essential representative shapes in this category along with a minuscule numbers of straight-sided vases, splayed out straight walled bowls, troughs and ring base pots; all having tan or chocolate slip right up to the base.

(iv) Black Burnished Ware

A few sherds in this category were found. This variety is represented by shapes like concave sided bowls, squat pots with blunt carination at the waist, straight sided bowls, etc. with featureless/slightly everted/slightly rounded/out-turned or tapering rims. One of the pots had a pre-firing graffiti 'X' on its base.

(v) Brown on Buff Ware

A single sherd of a vase with an out-turned rim represents this ware. Of medium fabric and not well fired, this vase is painted in brown with five horizontal bands below the neck and with festoons suspended from the last band.

(vi) Bi-chrome Wares

The shapes encountered in this ware are mainly vases and bowls. Paintings are executed on the exterior, over a red slip. The outline of the motifs is in black whereas the interior is filled with evanescent white. The painted motifs are geometric and floral-*pipal* leaf being the favourite in the latter variety (Fig. 8).

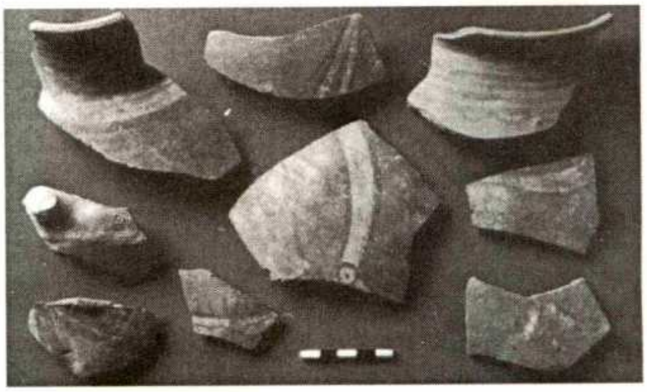

Fig. 8: Bi-chrome wares (©ASI)

(vii) Black on Red Ware

The common shapes in this category are mainly vases, bowls and cups. The painted designs are essentially geometric in nature comprising lines, loops, criss-cross and triangles, etc.

(viii) Red Ware

Simple red ware with common shapes like vases, bowls and cups made on wheel, were also found associated with the above categories of ceramics. All shapes are of medium fabric showing a slightly oxidised core and are devoid of any slip.

Discussion and Conclusions

The discovery of a large number of Hakra Wares sites (n = 99) in the areas surrounding the course of the currently defunct river Hakra[1], in Cholistan, Pakistan (Mughal 1997: 42-43) and its stratigraphic occurrence below the Kot Diji phase, i.e. Early Harappan level, at Jalilpur located in the former flood plain of the river Ravi, near Multan in southern Punjab of Pakistan, are significant finds. These discoveries firmly established the fact that in terms of chronology, the people using Hakra Wares were the predecessors of the Early Harappans. Some scholars have termed this stage of evolution in Harappan studies as the "Formative Period" (Gupta 1996: 50).

Recent excavations at Harappa by R.H. Meadows and J.M. Kenoyer revealed the existence of a separate horizon of Hakra Wares, which the excavators prefer to call the Ravi (Hakra-related) phase (Chakrabarti 2004: 11). Looking at the concentration of the Hakra Wares habitational sites in the Ghaggar-Hakra river basin, scholars believe that the Cholistan region must have been the homeland or "the core distribution area of Hakra pottery" (Gupta 1996:50; Chakrabarti 2004:11).

On the other hand, major excavations carried out at sites like Kalibangan and Banawali (Asthana 1985) and Rakhigarhi (Nath 1998-99: 46-49; 2000-01: 43-45), all located in the Ghaggar-Saraswati basin in India have not revealed a Hakra Ware horizon which predates the Early Harappan deposits. Rather the Hakra Wares appear only as associated wares of the known six fabrics of the Early Harappan levels at all the above mentioned sites. Another important excavation of a Harappan mound at Kunal in Haryana (Khatri and Acharya 1994-95: 84-86) has shown that its early level, i.e. IA "is dominated by the so-called Hakra Wares found in the lowest level of Jalilpur and is devoid of several Kalibangan-I fabrics. However, the most characteristic pottery of this period is dull red ware (or red washed) pottery with painted decorations in two colours-black outline and white filling." Yet no claim has been made for the existence of an independent stratigraphic horizon for the Hakra Wares culture. On the contrary, the Period IA along with IB and IC have been put together to represent as an exclusively rural settlement where the Early Harappans gradually metamorphosed into the Mature Harappans, the process of which is termed as "the Great Transition" (Gupta 1996: 70-78).

With regards to the settlement patterns of the Hakra Wares people, we have absolutely no information from the Cholistan region as no site has been excavated so far. But based on observations of the surface configuration of these sites, and from a study of material remains collected from explored sites, the explorer has classified the settlements into two categories, viz. (a) camp sites and (b) permanent Settlements (Mughal 1997: 42). Further the excavations at Harappa and Jalilpur have also not provided much information regarding the architectural remains of the period, except for the fact that the former site yielded a few badly damaged rectangular floors and circular pits with post holes, and the latter a few floors made of rammed earth on lime bedding. On the other hand, the Bhirrana excavation has brought to light a planned pattern of subterranean dwelling pit complexes covering a large area, and serving different domestic purposes. These pits are bereft of any brick lining or postholes around them. However, the existence of a superstructure of wattle and daub is confirmed.

A cursory glance at the antiquarian remains of the Hakra wares people at Bhirrana denotes that the people of this period attained technical maturity in producing copper objects. Although no object has been found as yet, this can be inferred from crucibles used for melting copper. Beads made on carnelian, agate, lapis lazuli and terracotta bangles are noted. Bangles made exclusively on terracotta, were predominant. Bangles were of two types; (a) red fired, single coiled and facetted terracotta bangles sometimes with black bands/ strokes decoration, having a plano-convex and squarish to rectangular cross-section, (b) light to deep grey coloured terracotta bangles of single, double and triple coiled (segmented), faceted with a plano-convex, circular and squarish to rectangular cross-section. These grey bangles bear pre-firing incised geometrical decorative motifs like chevrons, slanting lines, crosses made of slanting lines etc. Some were given a thick coating of slip and were burnished (Fig. 9).

Other noteworthy objects of interest of this period include a number of sun baked spherical clay lumps recovered from both dwelling and auxiliary pits (5 and 7). A few are roughly triangular in shape and are partially baked in fire. A fragment of a sun baked clay cake with a nail incision decoration from pit 7 and an *idli* shaped terracotta cake with a thumb impression in the centre of the top portion; and seven incised vertical strokes on its marginal end, are significant. They occur within a stratified

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[1] The upstream portion of is termed the River Ghaggar in India.

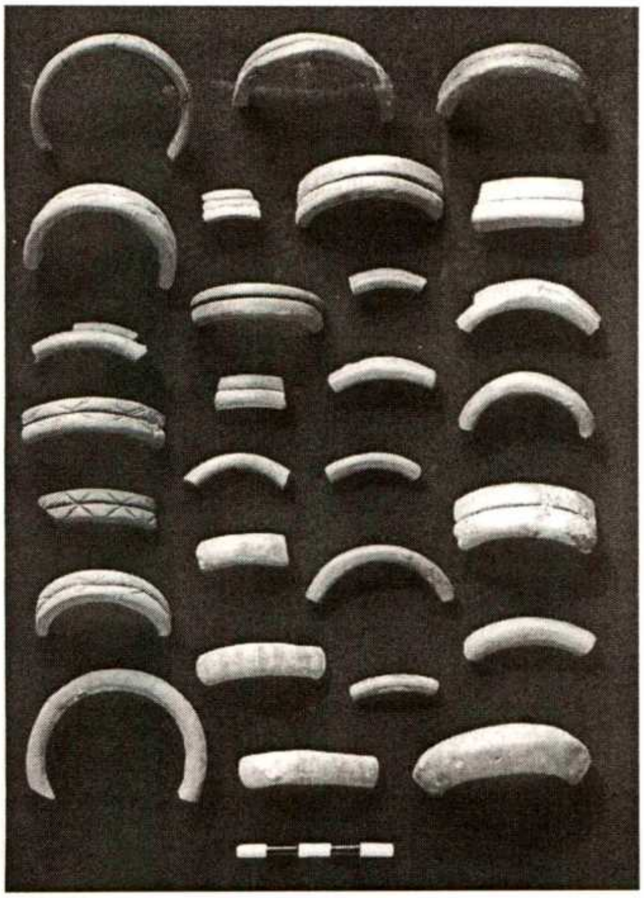

Fig. 9: Terracotta bangles (© ASI)

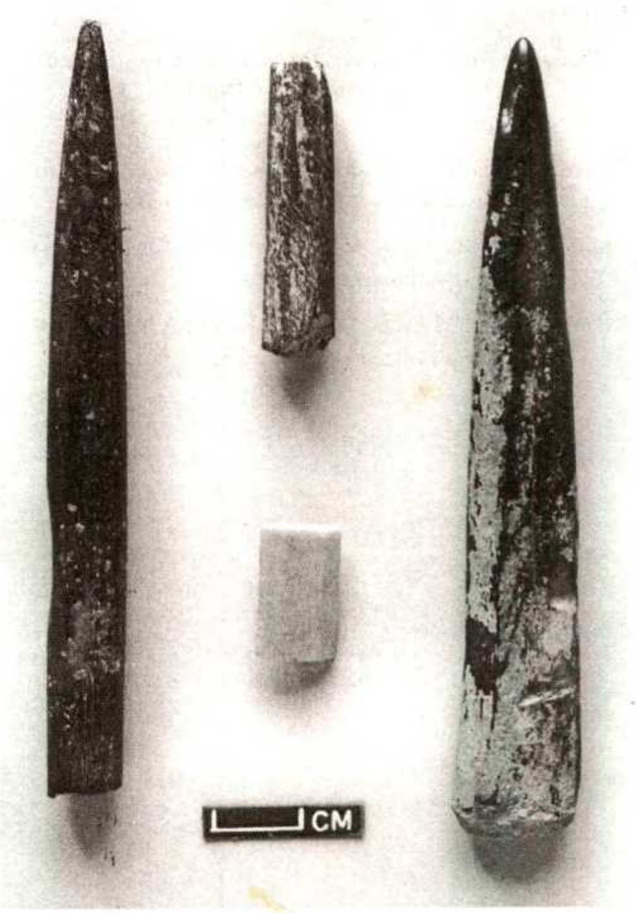

Fig. 10: Bone points and fragment of a parallel sided chert blade (©ASI)

deposit of this period and speak volumes about the origin of triangular and other shaped terracotta cakes which became so famous during the Mature Harappan period.

The occurrence of stone objects like pestles, pounders, rubbers, sling balls accompanied and by bone points (copper objects are yet to be found), and chert blades (Fig. 10) denote that an established village community using exclusively Hakra Wares existed. This community was not only agrarian, but supplemented their diet by hunting wild animals; and exploited domesticated animals. As a result of this a large quantity of charred bones were recovered from this period. Archaezoological Studies are in progress.

Other antiquities such as marbles of terracotta and sandstone, hopscotches made on red potsherds and an unfinished terracotta animal figurine, represent children's games and toys.

Of the seven ^{14}C dates coming from the Bhirrana excavation, sample BS No. 2333 of the Hakra Wares level has given a very early calibrated date of BC 6689-6201 (Rao *et al.* 2005). However, as per the present state of the knowledge, the origin of Hakra Wares Culture lies in the middle of the 4th millennium B.C. Therefore, to be on surer ground by a few more ^{14}C samples from Period IA collected during 2004-05 are being studied and the results are awaited.

The discovery of a Hakra Ware cultural period, for the first time in India, with an independent stratigraphic existence below the Early Harappan deposit at Bhirrana is very significant. This has not only established the spatial distribution of this culture in the upstream areas of the Hakra-Ghaggar-Saraswati river basin, but also indicates that the Hakra Wares people successfully evolved into the Early Harappans. It was during the later stages that technological advancement led to the development of new pottery fabrics, viz. six fabrics of pottery from Kalibangan whose roots can clearly be traced back to the preceding Hakra Wares. Interestingly, along with new fabrics, Hakra Wares continued to survive but with greater refined forms and features right through the Early Harappan to the Mature Harappan phases at Bhirrana.

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Lohari Ragho — A Harappan Satellite Site Revisited

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Abstract

While dealing with the distribution of cultural phenomena over space and in a particular time bracket, it is generally assumed that there is an unchanging relationship between parent and satellite archaeological sites. If a parent urban settlement is engaged in industry and trade, its satellites are thought to have been engaged in basic subsistence activities and are considered 'feeder' settlements. The present case study provides new insights into prehistoric economy where a reciprocal relationship existed between parent and daughter settlements.

Introduction

Lohari Ragho (29° 16' 29.3" N; 76° 04' 17.2" E) is a small village in the Hissar district of Haryana. It can be approached from Hansi via Sisai, or from Narnaund via the site of Rakhigarhi, the largest Harappan site in India. Numerous archaeological mounds have been reported from this region. Amongst these sites, a considerable number form a cluster of protohistoric settlements that lie along the Chautang River system – a major tributary to the Ghaggar River. Though both rivers are currently dry, water collects during the monsoon in depressions marking former courses. Although the presence of a large depression is noticeable near Rakhigarhi (Fig. 1); it does not take the form of a seasonal stream. Lohari Ragho's proximity to Rakhigarhi makes archaeological investigations at this satellite settlement very important (Fig. 2).

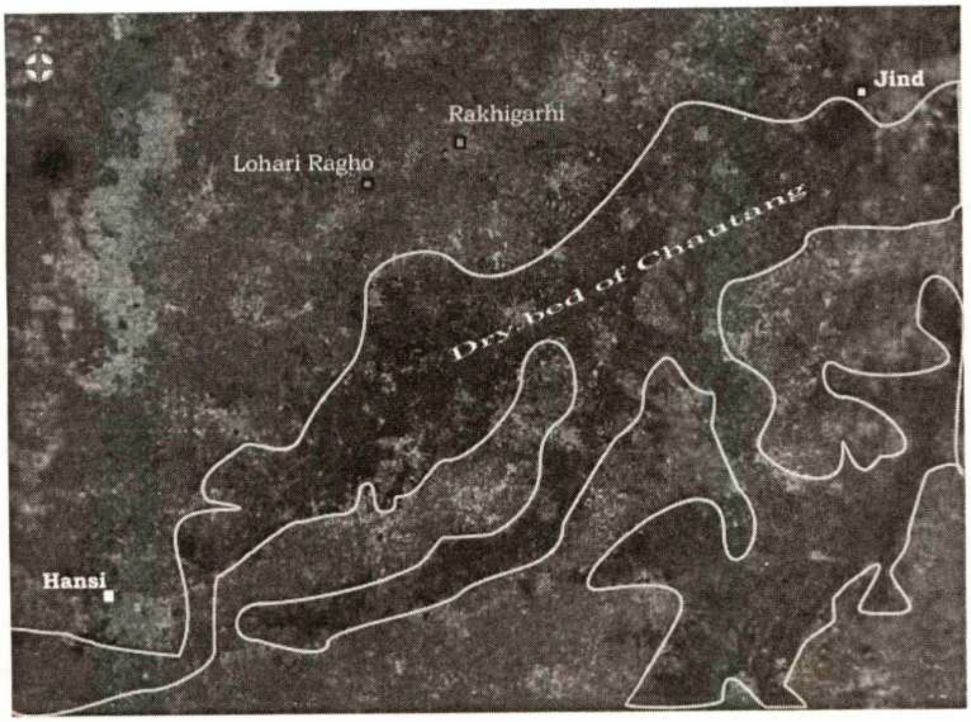


Fig. 1: The sites of Lohari Ragho and Rakhigargi

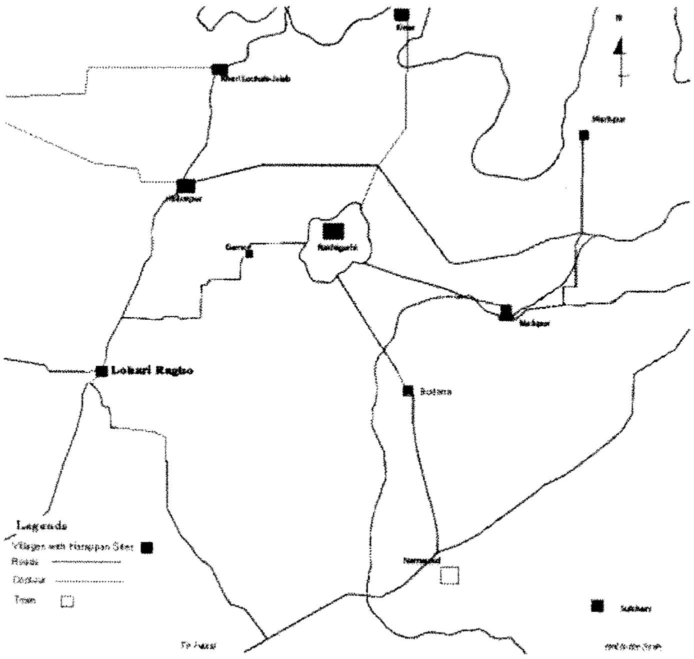


Fig. 2: Location of Lohari Ragho

Archaeological remains at Lohari Ragho were first reported by Dhoop Singh and Chanderpal Singh of the Department of Archaeology and Museums, Haryana (IAR 1980-81: 16). They reported two Late Harappan mounds (I and II) near the village but did not provide further information regarding their direction or location. Joshi *et al.* (1984) reported mounds in an article but ascribed them to the Early Harappan (Sothi-Siswal) period. A long list of sites published by him gives geo-coordinates, but the presence of two other localities was not noticed.

The mounds at Lohari Ragho were revisited by the author in 2000 as part of a dissertation project entitled "Site Catchment Analysis of Harappan Rakhigarhi". These investigations confirmed the Early Harappan and Late Harappan occupation at these mounds and also documented a Mature Harappan occupation. They were again visited in early 2005 for the purpose of refining the chronology, and to investigate their function and relationship with Harappan Rakhigarhi.

Natural Setting

The mounds are located on the bank of the currently dry bed of the Chautang River, which has been identified as the Vedic river Drishadwati. A palaeochannel runs through the modern districts of Yamunanagar, Karnal, Kaithal, Jind and Hissar of Haryana and Hanumangarh district of Rajasthan. It joined the River Saraswati close to Suratgarh. Near this strategic junction lie the sites of Kalibangan and Rang Mahal.

This area is part of the Indo-Gangetic alluvial plain. In general, the landscape is a flat, monotonous upland plain, the western portion grades into desert. The dominant topographic features are occurrences of aeolian sand dunes of varied shape and thickness overlying Pleistocene alluvium. The area experiences a subtropical, continental secondary, monsoon-type of climate with a prolonged hot period from March to October. The natural vegetation is tropical thorn forest consisting of plants like *Kikar, Jall,* and *Jar beri,* which is the most important bush. Common shrubs in the region are the *Bans, Vanvar, Babhool, Mallah, Karir, Phog, Khip* and *Ak.*

The suitability of soil for agriculture seems to have been an important factor determining site location for the Harappans. A macro-environmental survey of the region around Rakhigarhi (Garge 2001) indicates that most ancient mounds were situated on the edge of the Chautang river flood-zone. The Harappans of this region clearly gave first preference to class one cultivable land, located within the river's previous flood plain. There are several sites, which are however, located on moderately cultivable soils and a few are located on soils that are unsuitable for cultivation. The question may be raised as to why some sites were situated in such locations. What was their function? The site of Lohari Ragho provides a way to study this problem.

The study area is dominated by alluvium covered with aeolian sands (Ahuja and Singh 1983), but there are some pockets with a completely different character. Lohari Ragho is located in a small area comprising entirely aeolian sand. This tract is known as the *Behel Series* of soils (Ahuja and Singh 1983). Physiographically these soils consist of unstabilised sand dunes that are non-plastic, highly eroded and have a high evapo-transpiration rate. In all, these soils are not very suitable for cultivation (Fig. 3).

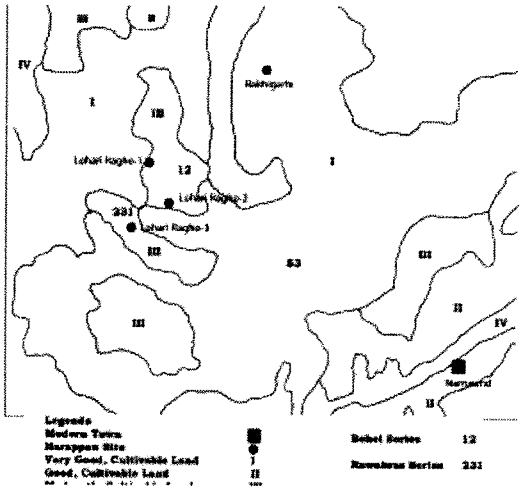


Fig. 3: Soils and land capability classes at Lohari Ragho

Only modern agricultural practices such as canal irrigation, use of fertilisers and dumping loamy clay on the surface have enabled recent agriculture at Lohari Ragho.

The Archaeology of Lohari Ragho (Fig. 4-6)

Three archaeological mounds are located in the vicinity of Lohari Ragho village (at average height of 208 m AMSL).

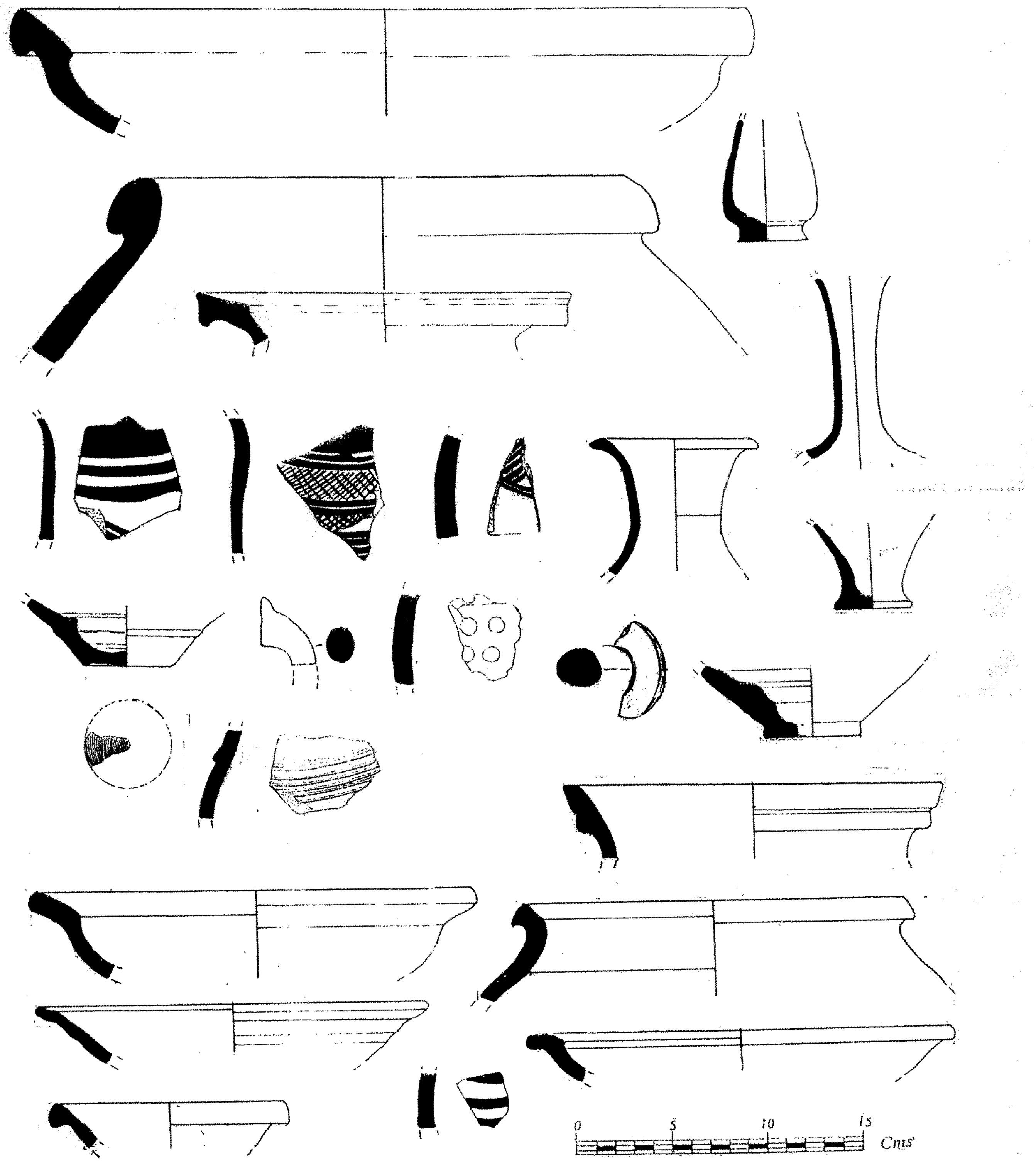
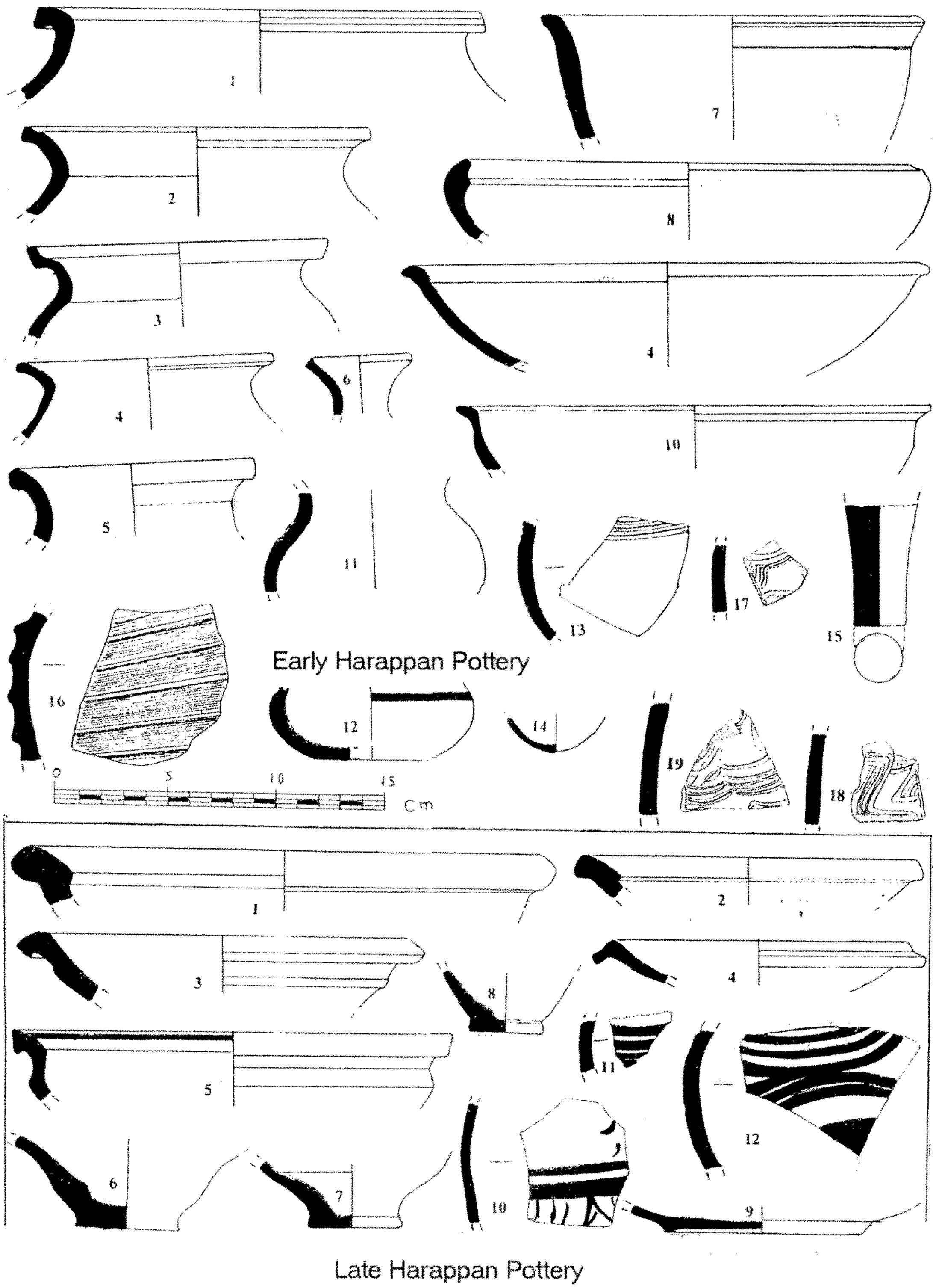


Fig. 4: Lohari Ragho: Mature Harappan ceramic assemblage



Early Harappan Pottery

Late Harappan Pottery

Fig. 5: Lohari Ragho: Early and Late Harappan ceramic assemblage

The two mounds, Lohari Ragho I and Lohari Ragho II are approximately 950 m apart. Another 1.5 km separates Lohari Ragho II from the third mound (Lohari Ragho III).

Lohari Ragho I

This is the closest of the three mounds and is located around 1.5 km to the east of the Lohari Ragho village. It lies near the Lohari-Haibatpur road. Agricultural fields surround the site but are absent at the centre. The mound (402 m north-south and 277 m east-west) lies approximately 2.5 m above the plain. A considerable quantity of potsherds, burnt-brick fragments and stone debitage are visible on the surface.

The ceramic assemblage collected from the surface indicates the presence of Early Harappan (Sothi-Siswal), Mature Harappan and Historical period occupations. The Early Harappan period is marked by finds of dull Red ware, rusticated, grooved, incised sherds, and chocolate-slipped ware sherds. Storage jars and globular pots are the only diagnostic shapes. The Mature Harappan pottery is mostly represented by Red ware with a thick slip, which is quite diagnostic. A few sherds with black horizontal bands were also found. Sherds of storage jars occur with cord impressions and thick black paintings. Another noticeable feature of storage jars, are the various rim forms such as the angular-beaked rim, which is perpendicular to the body, and the externally projecting, short rounded-out turning or beaded rims. Other common vessel forms are perforated jars, small shallow bowls, goblets and fluted pots. Vessels of this variety are wheel thrown and made of well-levigated, well-fired clay.

The Historical Phase here is indicated by the presence of a few thick chocolate slipped sherds. The appliqué variety is also found in coarse red pottery with a pinkish red slip. A feature of note is the decoration of rims by oblique incised lines or "nail impressions". Thick storage jars, thin vessels, small *matkas*, *handis*, lids and handles are the main ceramic forms of this phase.

Other antiquities include two circular terracotta cakes with tapering ends and thumb impression on one side, a terracotta 'hopscotch', bangle fragments with both square and round sections, a sandstone striker that was probably used to retouch long blades, and a round sandstone rubbing stone. Red sandstone debitage and a few fragments of quartz and chert were also recovered.

Lohari Ragho II

This mound is located approximately 950 m to the south of Lohari Ragho I. It is approachable by a dirt road from Lohari village as well as from the village of Gamada. It lies close to the Dhanala Kheda mound at Gamada where a Harappan occupation has been documented (Garge 2001). The centre is covered by natural vegetation. The mound is being levelled by agriculture and its current height is not more than one metre. It measures 276 m north-south and 218 m east-west. The surface is covered with potsherds and other small debris.

The ceramics collected from this mound can be assigned to the Mature Harappan and Historical periods. Mature Harappan pottery is dominantly represented by Red ware with occasional paintings in black. The main shapes are typical thick sherds of storage jars with short out-turning beaked rims, globular pots, medium-sized pots with out-turning rim, perforated jars, pointed-base goblets, and miniature pots. A shaft of a dish-on-stand is also reported. Some sherds also have grooves and heavy incisions. Painted motifs include vertical and horizontal bands as well as *jalli* or criss-cross patterns. Historical period pottery is represented by coarse pinkish Red ware. The main shapes present are small pots, shallow small bowls, handles as well as globular pots.

Three terracotta cakes of circular shape with a flat section, two hopscotches made on thick potsherds, stone sling balls, a cylindrical whet stone made of sandstone and a few other stone objects were recovered. They are made of sandstone, granite and quartzite. Brick bats of burnt brick as well some complete burnt bricks are seen on the surface of the mound. The size of each brick is 30 x 15 x 8 cm (1:2:3 ratio) characteristic of the Mature Harappan phase.

Lohari Ragho III

This mound is also located on the Lohari-Haibatpur road, 3 km to the northeast of Lohari, and approximately 5.5 km southwest of Rakhigarhi. Travelling in an easterly direction across the fields, the mound is approachable by a cart track. A brick-kiln or *chimani* is located to northwest of this mound. The land is under private ownership.

The mound (354 m east-west and 277 m north-south), roughly oval in shape, has been cultivated and now comprises stepped rectangular and square agricultural fields. Although the central portion has been levelled using tractors, it still rises to almost 3.5 m above the surrounding ground level. Potsherds are found in a large quantity all over the surface. Brick bats and stone objects are also seen. On the north-eastern side of the mound, patches of ash and burnt bone fragments are noticed at regular intervals. These white patches are round or oval in shape (diameter approximately 0.70 to 1.5 m). Over-fired terracotta *mustikas* or round terracotta cakes are found around the patches. The ashy whitish-grey soil of the mound gives it a distinctive appearance (Fig. 6).

Only a few Early Harappan sherds have been found confined to fields to the east of the site. They comprise fragments of the thin walled, grooved, and incised pottery forms typical of this phase. Mature Harappan sherds are found on the remaining portions of the mound. Thick slipped red ware is dominant. Among the forms found are dishes, dishes-on-stand, goblets, small globular pots, shallow basins and storage jars. A few examples of grooved, incised (with horizontal wavy bands) and fluted varieties were also found. Several sherds of Red ware were found with horizontally painted black bands. Storage jars with beaded out-running and narrow external projecting

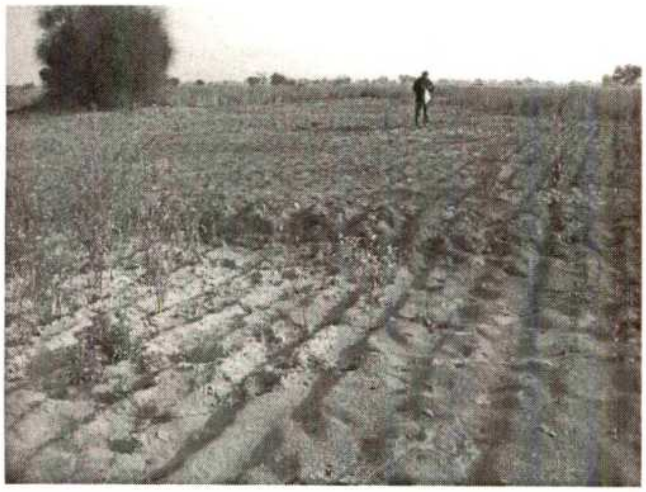


Fig. 6: Lohari Ragho III: circular ash patches

rims and a few grey sherds were also found. Dishes with narrow bilateral projections and flat base are sometimes seen. Pointed-base goblets are also found. The Early Historical ceramic assemblage largely comprises coarse pinkish Red ware with forms such as *matakas*, storage and spouted jars, and lids. The rims of some bowls are decorated with two horizontal bands painted in black, with oblique or tilted lines incised within.

A dull red slipped sherd was found with a graffiti mark resembling an arrowhead or a type of boat. A few fragmentary circular terracotta cakes, fragments of a terracotta toy-cart frame and one head of a bull were also recovered. Many terracotta bangle fragments (a few with rectangular sections but most with round sections) came to light. Stone objects include two large rough pink quartzite grinding stones, a round stone of fine-grained quartzite that may have been used as a weight, and a broken limestone muller. A few shell collumelae and fragments of faience are among the noteworthy antiquities.

Discussion

Locational analysis of a site in the context of its environment is important as resources available within a site's catchment area greatly influence it's function. When a site is part of a complex exchange network, the activities that take place may vary greatly. In the case of Lohari Ragho, there are practically no sources of raw material (with the exception of clay, wood, animal bones and probably ivory) which could be used for manufacturing activities.

In the case of Rakhigarhi, the excavator Nath (1998: 41-42) noted that "... overwhelmingly rich surface features together with volume and size of the mounds amidst vast arable plains suggests primarily agriculture based subsistence pattern since the days of first occupation at the site. The agricultural waste and vast grazing land around the site must have given rise to animal husbandry. The agro - pastoral character of the site never got margined, other traits of subsistence remained subordinate". While food production at Rakhigarhi may have been predominant, three seasons of excavation at the site have shown that its economy was nonetheless complex and varied. There is clear evidence of a range of local craft and manufacturing activities. The existence of fire chambers, a sandstone quern and a sandstone anvil found along with shell debitage and ash, and a possible textile dying area unearthed from Early Harappan levels suggest early beginnings of craft specialisation. The elaboration of craft activities is evident in the Mature Harappan period. The presence of a potter's kiln, and a lapidary workshop including a large quantity of semiprecious raw materials, beads in different stages of production along with debitage and material discarded during manufacture, a sandstone anvil, bead polisher and U-shaped kiln, working floor with drill bits of chert are significant. A steatite bead- manufacturing site was also noted. Hundreds of finished and unfinished steatite beads were found along with bead roughouts, kilns of different sizes and large pots for baking nodules. The brick lined hearths with anvil on the same floor and debitage of collumelae of *Turbinella pyrum* show evidence of shell working. Besides, there is also evidence of burning shell for lime (Nath 1999: 46-9, 2001: 43-6). Most of the raw materials needed to conduct these activities as well to accomplish many of the day-to-day utilitarian tasks were not available within the immediate catchment area of Rakhigarhi. The presence of raw materials from outside the immediate area indicates that residents were involved in long distance acquisition networks. To acquire materials such as quartzite, copper, gold, silver, lapis lazuli, carnelian, turquoise, ivory and marine shells, the Harappans of Rakhigarhi either had to travel beyond the immediate catchment areas or participate in complex exchange mechanisms.

For this study, the ancient localities around Lohari Ragho were plotted on a soil map. The character of soils on which sites were situated indicated that they may not have been primarily agricultural in nature. Natural vegetation suggests a more pastoral orientation. Surface studies and sampling of these sites have offered conclusive evidence of their function(s). Surface investigations at Lohari Ragho III revealed a concentration of white circular patches of ash ('kilns') that were spaced at regular intervals and had average diameters of around one metre (Fig. 6). As many as 17 such kilns, associated with over-fired terracotta cakes and cracked burnt bones, were noticed in a compact area of 75 x 50 m. Another important finding is the presence of collumelae of *Turbinella pyrum* (Fig. 7), which indicate that marine shell bangles (a few fragments of which have also been found) were being manufactured at this location over 1000 km from the ocean. The rich

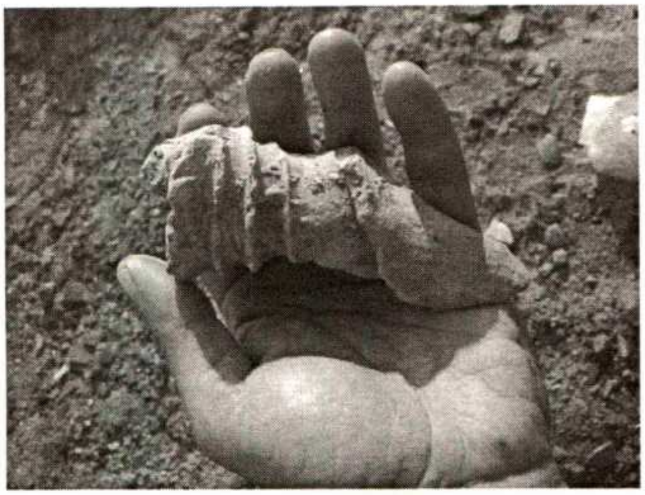


Fig. 7: Lohari Ragho III: collumella of *Turbinella pyrum*

material culture as seen in the form of terracotta figurines and bangles, various stone objects like grinders and polishers of quartzite, all strongly suggest that the economy of the Lohari Ragho sites was more than merely agro-pastoral in nature.

The available evidence provides new insights into the economy of the Harappan Civilisation. The parent-daughter relationship of main settlement (Rakhigarhi) to its satellites (Lohari Ragho I-III) seems to have been more complicated than previously thought. Prior to this study, satellite sites were considered as 'feeder' settlements providing basic subsistence to the main site. Presumably, in exchange, they obtained manufactured goods or valuables which could be exchanged for other items. The inhabitants around Lohari Ragho were certainly independent in terms of their basic subsistence. Lohari Ragho I is very close to the flood-plain zone of the Chautang River and so the agro-pastoral subsistence base of this site cannot be ruled out. Though Lohari Ragho II and III are located on non-agricultural lands, it is possible that some of the population might have been engaged in pastoral activities. The presence of stone debitage, sandstone strikers and fragments of chert blades on the surface of Lohari Ragho II suggest, however, that they were also engaged in craft-manufacturing activities. The industrial nature of Lohari Ragho III is very clear, but industrialisation does not necessarily denote an urban character. All satellite sites must have been dependent on their urban mother settlement for obtaining certain raw materials and to market their manufactured goods. A reciprocal relationship clearly existed between Harappans at Rakhigarhi and Lohari-Ragho.

Natural factors are responsible for shaping the character of a culture as well for its expansion in time and space. However, sustaining its cultural character is largely attributed to the adaptive capacity of human beings in the face of both environmental and socio-techno-economic factors. Locational analysis and surface sampling are important tools with which to learn about the function and nature of a settlement. The hypotheses outlined here must eventually be tested by further survey and excavation.

Acknowledgements

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Biographies of the Skeleton: Pathological Conditions at Balathal

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Abstract

The small assemblage of human remains from Balathal (5 adult individuals) presents a unique opportunity to examine the biocultural characteristics of people from the Ahar Culture of Chalcolithic and Early Historic Rajasthan. This small sample represents the first collection of human remains to be published from this chrono-cultural context in Rajasthan. Although the sample size is small, and thus no palaeodemography or biodistance studies will be attempted, there is a wealth of information about lifestyle in the Chalcolithic period presented in pathological conditions of the skeletons. Within this collection, we have found evidence for cervical and thoracic spondylosis, vertebral compression fractures, degenerative joint disease, a lunate fracture, a fracture of the anterior ischiopubic ramus, and dental disease. In addition, skeletal remains from an Early Historic occupation of the site were found buried in a posture that has been described as reminiscent of the *samadhi* position of *modern* Hinduism. This paper describes the human remains and the pathological conditions that were observed during our investigation in the early part of 2001.

Introduction

The Chalcolithic period in India is broadly defined by the presence of copper and distinctive ceramic types in association with an economy based on agriculture, some pastoralism, occasionally supplemented by hunting and fishing. The period was regionally diverse and excavations of sites belonging to the Ahar culture are distinguished from Deccan Chalcolithic sites in material culture and mortuary practice. Over ninety sites have been identified in the Mewar region of Rajasthan in Northwestern India, most of which are located in river valleys in the districts of Udaipur, Chittaurgarh, and Bhilwara (Misra *et al.* 1995). Only three of these sites have been systematically excavated thus far. Most of our information concerning the Ahar culture derives from excavations at the type-site of Ahar, which spans the third to the beginning of the first millennia B.C. Gilund has contributed less information to date but recent investigations undertaken by V.S. Shinde and G.L. Possehl should provide additional insights on this period of protohistory of eastern Rajasthan. Ahar and Gilund yielded no human skeletal remains and thus Balathal represents the first opportunity to examine biological characteristics, biocultural adaptations, palaeopathological profiles, and affinities of human remains from the Chalcolithic period in this region.

Materials and Methods

The site of Balathal (24° 43' N; 73° 59' E), discovered by V.N. Misra in 1964, is located approximately 40 km northeast of the modern city of Udaipur and 6 km from the tehsil town of Vallabhnagar (Fig. 1). The site consists of one mound of occupational deposit, which now covers an area of 90 m (N-S), 80 m (E-W) and is 7 m in height (Misra *et al.* 1995). The Chalcolithic period at Balathal (C-14 dates spanning 5000-3800 BP; Misra 2005) has been divided into two successive phases. Phase A of the Chalcolithic (Ahar) culture (5000-4400 BP) is characterised by circular mud as well as mud-brick and stone residential structures, coarse handmade as well as wheel-made plain and painted ceramics, an absence of stone blades, a few copper fragments and semi-precious stone beads, and no associated burials. Phase B (4400-3800 BP) consists of residential and other structures constructed of stone and mud brick, wheel thrown ceramics, an increase in the quantity of copper implements, and three adult burials. It was during Phase B that a large stone enclosure (ca. 600 m^2) was constructed in the centre of the settlement. The Chalcolithic deposit is sealed by a sterile layer (layer 5) of homogenous dark grey silt, 40-100 cm in thickness, overlying a thick base of angular stones. Above this sterile layer are deposits from the Early Historic Period (2200-1800 BP), which is characterised by

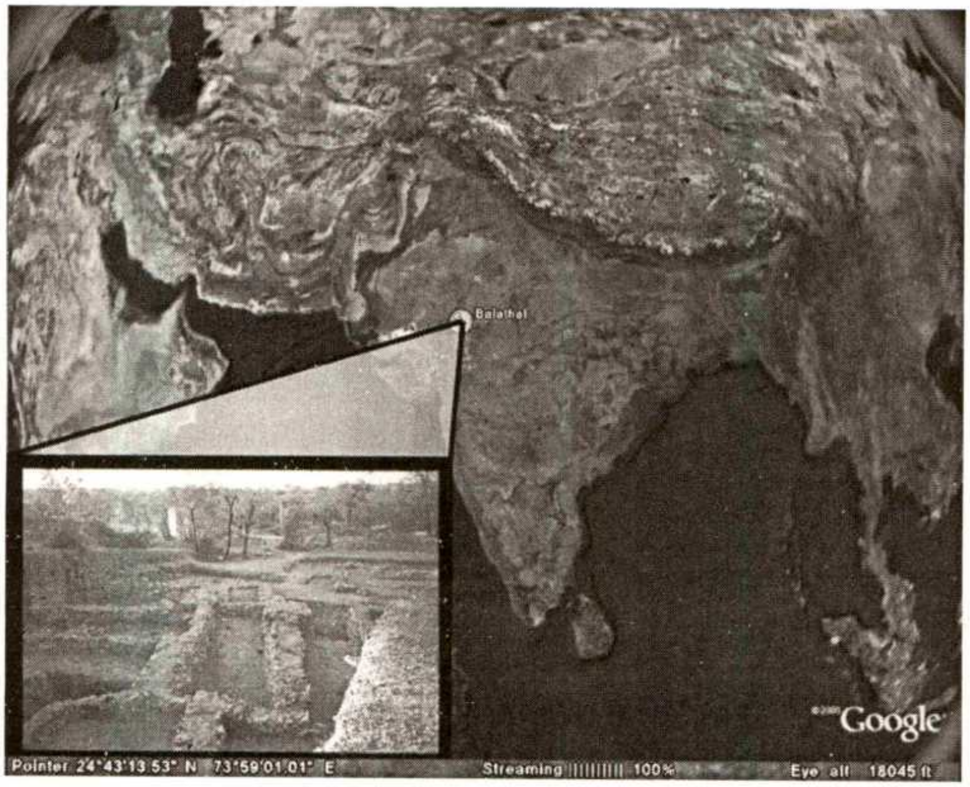
Balathal
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Fig. 1: Map of India showing the location of Balathal

iron technology, plain red and grey ceramics, copper coins, beads of terracotta and semi-precious stone, animal and human figurines, seals, and wattle and daub residential structures, faunal remains of domesticated animals and charred grains of *urud* and *moong*, as well as two adult burials.

The provenience, burial posture, orientation, and relative chronology of the burials are provided below (Table 1). The remains were inventoried and described according to standard procedure of data collection (Buikstra and Ubelaker 1994). This paper describes the pathological conditions noted in the skeletal and dental remains during the preparation of the complete inventory and report on the skeletal remains, which is being published separately in this journal. For this analysis, age was estimated using standards for dental attrition (Brothwell 1981) and attrition was reported using Scott (1979) for the anterior teeth and Smith (1984) for the posterior teeth. Age was also estimated using postcranial epiphyseal fusion (Buikstra and Ubelaker 1994), pubic symphysis morphology (McKern and Stewart 1957), and cranial suture closure (Todd and Lyon 1924) according to the elements preserved. Sex was estimated for this sample using pelvic morphology (Bass 1995; White 1999; Pickering and Bachman 1997), mandibular morphology (Loth and Henneberg 1996), cranial morphology (Bass 1995; White 1999; Pickering and Bachman 1997), long bone lengths (Bass 1995; White 1999; Pickering and Bachman 1997), and skeletal robusticity. Measures of the long bone articular surfaces that provide sex estimates, such as the maximum diameter of the humeral or femoral head (Dittrick and Suchey 1986; Bass 1995; White 1999; Pickering and Bachman 1997) were not possible for specimens 1999-1 and 1999-2 as these individuals remain in a block of soil. These methods were not necessary for 1997-1 and 1999-3 as pelvic indicators were available.

A full description of the human remains and state of preservation for the adult burials will be available in the excavation report. This paper describes the pathological conditions noted in the adult skeletons and looks at them from a perspective of individual biography rather than from an epidemiological perspective that would be afforded by a larger assemblage. Out of the five adult skeletons present, two individuals (1997-2 and 1999-2) showed no evidence of skeletal pathological conditions. The remains of 1997-2 were too fragmentary to assess skeletal pathological conditions however dental conditions are included in the discussion below. The remains from 1999-2 were fairly complete below the thoracic region. However this individual remains in a block for museum

Table 1: Provenience, age and sex estimation for adult burials

Individual	Cultural association	Burial posture	Sex	Age estimate (years)	Mean age	Skeletal pathology
1997-1	Early Historic	flexed on L side	M	30-50	40	OA, VOP, cervical spondylosis, and lunate fracture
1997-2	Early Historic	co-mingled	-	17-32	25	None
1999-1	Chalcolithic	flexed, on R side	F?	35-55	45	Schmorl's node C2/C3
1999-2	Early historic	seated with hands on knees	M?	20-40	30	none observed
1999-3	Chalcolithic		F	25-35	30	thoracic compression fracture, spondylitis, pelvic fracture, sub-luxation of the acetabulum, necrosis of the femoral head

exhibition because of its unique burial posture (Fig. 2). There was no evidence of pathological modification on the visible surfaces. Pathological conditions discovered in the osseous remains of 1997-1, 1999-1 and 1999-3 are described below.

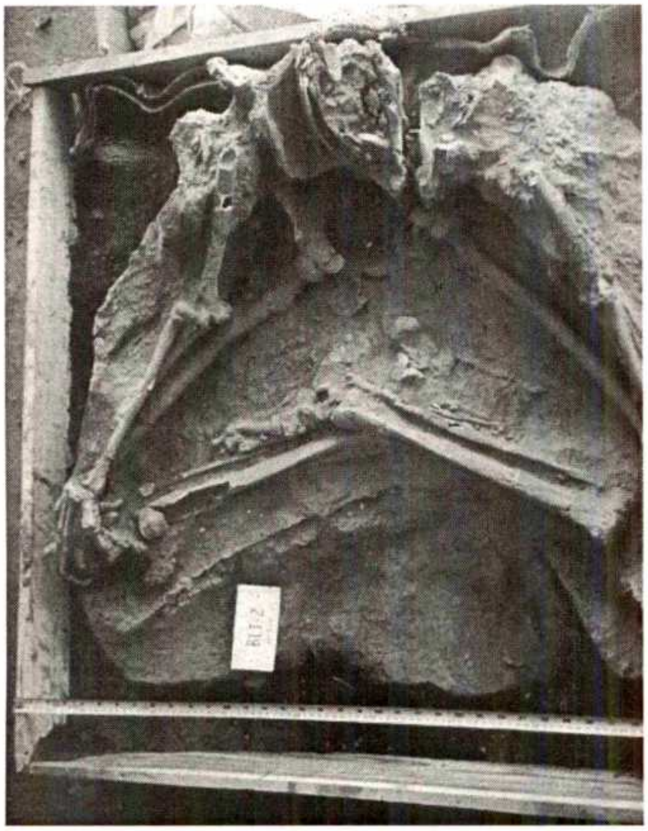

Fig. 2: BTL 1999-2 *Samadhi* style burial posture

Skeletal Pathological Conditions

Degenerative joint disease

Degenerative Joint Disease (DJD) is the most commonly represented pathological condition in human skeletal collections after dental pathologies and is thus the most frequently studied category of skeletal pathological lesion. Osteoarthritis (OA) is defined as a chronic degenerative arthropathy in which the breakdown of joint cartilage frequently leads to chronic pain and disability. OA is associated with the following bony changes: osteophytes, porosity, and eburnation. OA is the most prevalent form of DJD in literature from modern clinical practice, affecting 80% of adults over 45 years of age in the United States (Regan 2005; Roberts and Manchester 1995).

The presence and patterning of these lesions in skeletal samples is commonly used to infer behaviour despite (a) the lack of solid information regarding the etiopathogenesis of the condition (or disease), and (b) despite discrepancies in clinical literature concerning the correlation between osteoarthritic lesions and activity patterns (Jurmain 1999). The etiopathogenesis of OA is complicated and is not fully understood. Two types of osteoarthritis have been distinguished. Primary OA is the purely idiopathic variety and secondary OA is caused by a combination of factors. Older age, female gender, obesity, activity level or repetitive stress, prior injury, altered biomechanics, heredity, congenital and developmental anomalies, metabolic or hormonal imbalances, nutrition, inflammation, and diseases such as Paget's disease and gout are all predisposing factors for OA (Jurmain 1999; Ling and Bathon 2005).

The list is of course not a recipe for osteoarthritis but the development of secondary OA is thought to be related to a combination of these predisposing factors. The condition is positively correlated with time: age of the individual, age of onset of the condition, duration and intensity of the stress, and recovery time between stresses. Prior injury and joint trauma are also strongly predisposing factors, whether acute severe trauma or chronic fatigue (i.e. associated with posture). For example joint biomechanics due to the posture required for bipedalism appears to be the most important causal factor in spinal involvement (Bridges 1991), whereas long term, prolonged, vigorous exercise and weight bearing is not necessarily associated with diarthrodial joint involvement in the absence of prior injury or developmental anomaly. People who frequently run often have healthier joints than do more sedentary people (Jurmain 1999: 95).

The contradictory nature of the literature is not limited to etiopathogenesis. Clinical and osteological criteria for diagnosing osteoarthritis differ due to the difference between radiographic diagnoses as compared to a direct examination of the bone surfaces. Radiographic methods may underestimate OA prevalence and osteological examination may overestimate, if the presence of osteophytes alone is used as a diagnostic criterion. In addition, individuals sampled in clinical studies may have age-related biases, predisposing conditions, and behavioural biases (i.e. more willingness to see a physician or lower pain threshold). These sample and methodological differences between medical and bioarchaeological studies make comparisons difficult to impossible (Bridges 1991, 1992).

Some osteologists have recommended that osteophytes should be excluded from the calculation of population frequencies for osteoarthritis unless they occur in conjunction with other lesions, such as eburnation and porosity (Waldron and Rogers 1991; Jurmain 1999). Most workers agree that all manifestations of bone change at joint surfaces should be recorded, but they differ on whether they should be recorded separately and whether they should be analysed separately (Jurmain 1999).

For this analysis, each diarthrodial and apophyseal joint surface was observed separately and the presence of osteophytes, porosity, and/or eburnation classified using the system developed by Buikstra and Ubelaker (1994) (Fig. 3). Two of the most complete and best preserved of the five individuals (1997-1, a 40 year old male and 1999-3, a 30 year old female) had severe osteophytic lesions; both of these individuals were from Phase B of the Chalcolithic period (Table 1).

BTL 1997-1 had many lesions distributed throughout the vertebral column, ribs, shoulders, elbows, and hips. In general, the right side of the axial skeleton (the spine) was

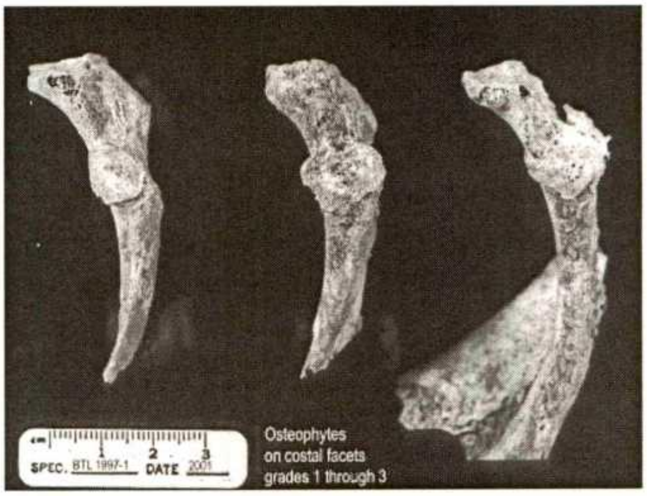

Fig. 3: BTL 1997-1 Osteophytes on costal facets of ribs (grades 1 through 3 demonstrated from left to right)

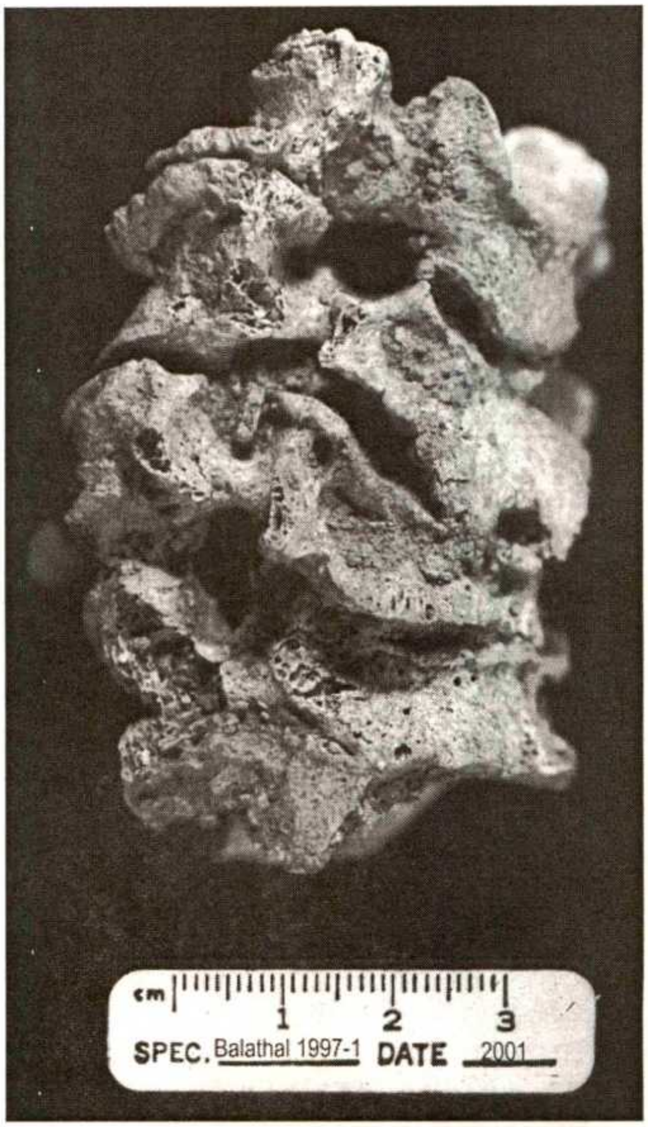

Fig. 4: BTL 1997-1 Cervical vertebrae 3-7 (right lateral oblique view)

slightly more affected than the left in terms of severity and frequency. The left side of the appendicular skeleton was primarily affected. In order of number of surfaces affected and severity, the spine and vertebral ends of the ribs suffered from the most degenerative change, the shoulders and hips followed, the elbows were the least affected joints. The temporo-mandibular joint, hands, feet, and left knee were unaffected. In modern populations, the distal and proximal interphalangeal joints of the hand are generally most affected, followed by the spine (Ling and Bathon 2005).

OA affected two regions most severely in this individual (Figs. 4- 6): the lower cervical vertebrae (C4 to C7) and the lumbar spine (T10 to L5). This individual suffered from compression on the ventral surface of the sixth cervical vertebra. The deformation of the column was associated with ankylosing of the affected and proximal vertebrae. Compression of the vertebral centrum is associated with several conditions: osteoarthritic wedging, osteoporotic fracture, cervical spondylosis, tuberculosis (Pott's disease), sickle cell anaemia, and acute trauma causing hyperextension of the neck usually through a blow to the occiput (Lovell 1997). Direct traumatic injury is ruled out in this case as it should be associated with other damage, such as injury to the occipital bone or the spinous processes in the upper cervical region. Sickle cell anaemia is also ruled out in this case as there was no evidence for porotic hyperostosis or cribra orbitalia. Tubercular kyphosis is commonly associated with collapse of the thoracic vertebrae (40-50% cases) (Hewish 2004) but there was no evidence for tuberculous spondylitis, such as osteomyelitis in the spine.

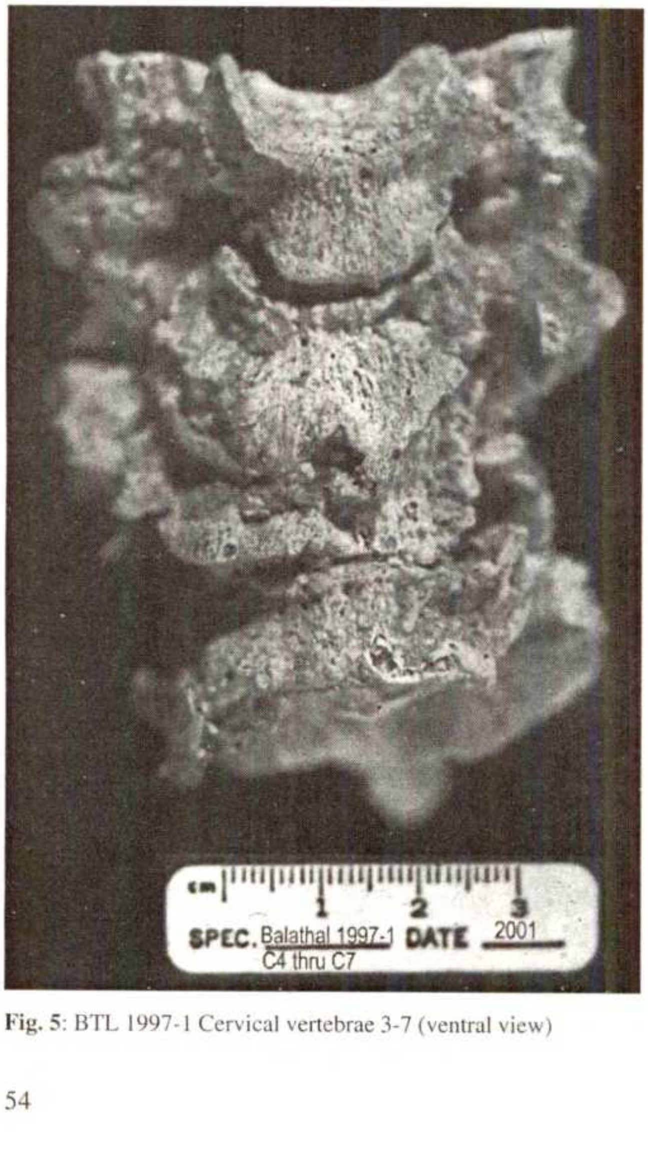

Fig. 5: BTL 1997-1 Cervical vertebrae 3-7 (ventral view)

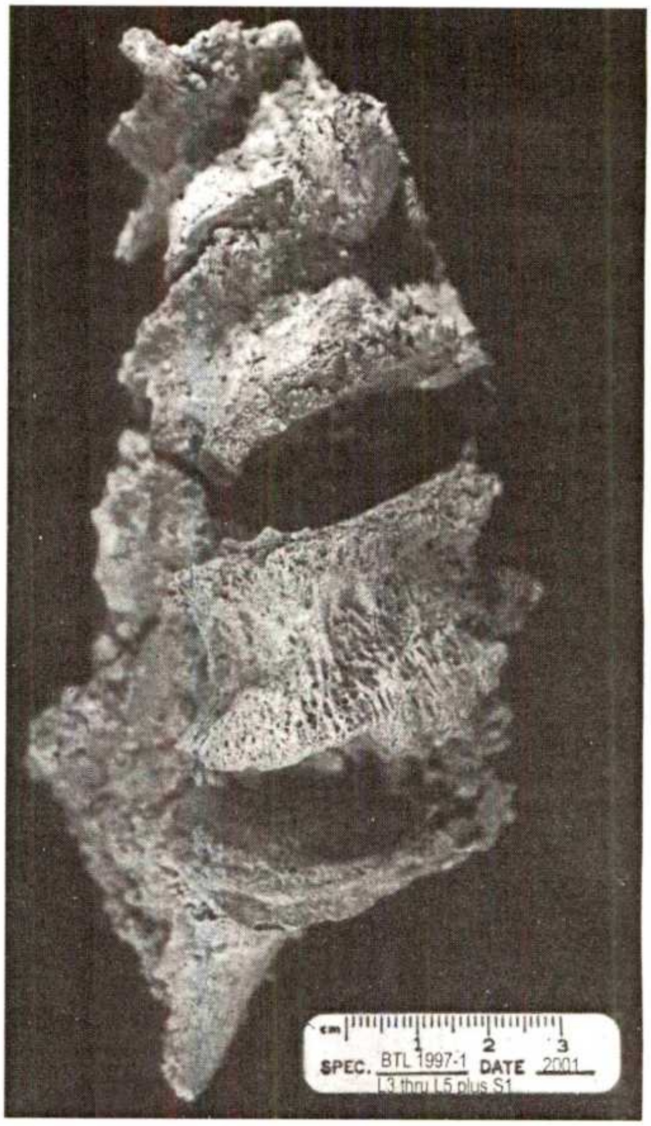

Fig. 6: BTL 1997-1 Lumbar vertebrae 3-5 and portion of S1 (ventral view)

The lumbar spine was significantly affected by marginal osteophytes (Fig. 6). Lumbar spine osteophytes are the most common manifestation of OA in the spine, with 75% of men and 61.1% of women with OA affected in the lumbar region in modern clinical practice (Liu *et al.* 1997). Osteophytes are also common in the hips: with 31.7% of men and 27.4% of women with OA affected in the hip region (Liu *et al.* 1997).

The distribution and severity of OA in this individual, including the widening of the vertebral centra and osteophytosis of the centra and articular facets throughout the column supports a diagnosis of cervical spondylosis. Age-related changes, such as thinning of intervertebral disks and loss of bone mass, reduce the load-bearing capacity of vertebrae. The vertebral body of a young person may support 1,000 kg while an elderly individual's load-bearing capacity is reduced to 80-150 kg (Biewener 1993). Loading in these circumstances causes one vertebra to move in an irregular manner against another vertebra; the normal relationship between the two bones is lost and a condition of instability results. Excess bone growth is an attempt by the body to stabilize the region and permit more normal bone interaction. The bones respond to shifting load dynamics with new periosteal bone and osteophyte formation that increase the diameter of the vertebral body (Bedford *et al.* 1952; Arnold 1955; Simeone 1982). These changes in turn cause further disc degeneration because stress is no longer evenly distributed and cushioned (Biewener 1993). Eventually, osteophytes around the apophyseal and articular joint surfaces of the spine can impinge upon nearby nerves, blood vessels, and even the spinal cord itself. This often leads to vertebral fragility and spinal stenosis (Bedford *et al.* 1952; Arnold 1955).

Cervical spondylosis can be a normal result of aging in some individuals. In fact, cervical spondylosis is an extremely common condition in modern clinical practice, the most common spinal cord dysfunction in individuals over the age of 50 (Simeone 1982). It is usually the end result of chronic, long-standing disc degeneration. This condition can also be related to vertebral subluxation secondary to weight bearing on the head, a common practice in India today and possibly in the past (Lovell 1997). Given the evidence for osteoarthritis in many of the diarthrodial joint surfaces of this individual, it may indicate that this individual performed some form of hard labour in life.

Individual 1999-1 was relatively healthy from a skeletal perspective considering her relatively more advanced age of over 40 years. The only pathological condition expressed in the skeletal remains available for examination was one incipient Schmorl's node developing on the superior surface of the centrum of the third cervical vertebra, and a corresponding depression on the inferior surface of the axis centrum (second cervical vertebra). Schmorl's nodes result from herniation or bulging of the vertebral disc, often because of a loss of resiliency of the cartilage (Lovell 1997). This "bulging" of the intervertebral disc puts pressure on the apophyseal surface that leads to resorption and is manifest as a small depression in the surface (Lovell 1997). Over time this disk degeneration can lead to spondylosis but there was no hyperostotic reaction in this case. Schmorl's nodes may be caused by chronic stress, trauma, hyperparathyroidism, infection, and metastatic carcinoma (Yamaguchi 2003). A congenital predisposition has also been suggested (Yamaguchi 2003). When these lesions are found in younger individuals, without any other evidence for degenerative joint disease, it is likely that they have resulted from trauma or heavy, compressive loading on the cranium.

Individual 1999-3 (a female over the age of 30 years) suffered from vertebral compression fracture and degenerative joint disease as well. This individual had a compression fracture on the ventral surface of one thoracic vertebra and five vertebrae adjacent to the compression fracture had severe vertebral osteophytes, which had ankylosed and resulted in the fusion of these centra. The vertebral column showed no other evidence of even mild VOP, thereby suggesting osteoarthritis was not the cause of the vertebral body collapse. This woman was relatively young (30 years estimated age) and demonstrates no evidence for osteoporosis either. There is no evidence of metastatic disease, which can also cause spinal compression.

Thoracic compression fractures, when not attributed to osteoarthritis or osteoporosis, are often the result of falls, injury, or excessive pressure/loading of the spinal column. Anterior wedging in a thoracic compression fracture can result from a fall, particularly if an individual is bending forward during the fall, a position which puts the majority of the pressure on the anterior portion of the centrum. Thoracic spondylosis can be caused either by activity or injury, when it results in inflammation of the tissue surrounding the vertebrae. Thoracic spondylosis is often associated with degenerative osteoarthritis, but OA is not supported in this case because of the young age of this female, the lack of additional evidence for OA in the diarthrodial joints, and the presence of alternative reasons for joint disfunction resulting from several fractures described below. The thoracic compression fracture, pelvic ring fracture, and subluxation of the femoral-acetabular joint in this individual may have limited mobility and caused the thoracic region to become slightly displaced, resulting in the inflammation, hypertrophy, and fusion of the vertebrae.

Although spondylosis probably resulted from trauma in this individual, it can also result from Ankylosing Spondylitis (AS). AS is a progressive rheumatic disease in which chronic inflammation at entheses (attachment sites for ligaments and tendons) leads to progressive erosion of the bone at that site. When inflammation subsides, new bone forms at the site of the enthesopathy and movement becomes restricted. Eventually the repetition of this process leads to the fusion of the affected joints or vertebrae. This condition most commonly affects the pelvis and the spinal column, particularly the pelvis in females. There was no evidence for AS in the pelvis.

In summary, degenerative joint disease was the most common pathological condition in the Balathal collection. Two individuals suffered from compression fracture and associated spondylosis: one from degenerative joint disease and OA that affected many of the diarthrodial joints as well and the other from traumatic injury that also affected the pelvis and femur. One individual had an incipient Schmorl's node in the cervical region but was otherwise healthy from a skeletal perspective.

Fractures

Individual 1997-1 suffered from a fracture of the left lunate on the articular facet for the scaphoid (Fig. 7). Upper-extremity fractures are among the most common fractures of the skeletal system (Kouris 2005). However, fractures of the carpal bones are rare because the bones of the wrist are tightly bound together by ligaments (Geissler 2001). Carpal bone injuries comprise 18% of hand fractures and bones in the proximal row are more commonly fractured than the distal row (Kouris 2005). Fractures of the scaphoid and triquetral ridge are the most common and often result from indirect trauma or high-energy impacts such as falling on an outstretched hand (Lovell 1997). Lunate fractures are rare and account for only 0.2% of all carpal fractures in modern clinical practice (Altinok *et al.* 2004).

Lunate fractures most commonly result from repetitive stress injuries, as a result of a direct blow to the ulnar aspect of the wrist, or from forceful hyperextension, such as in a fall on outstretched hand (Altinok *et al.* 2004; Kouris 2005). Carpal fractures often require prompt attention to avoid permanent loss of range of motion and fracture of the lunate is associated with loss of range of motion and grip strength (Kouris 2005). Fixation is described in the clinical literature as crucial for "preserving critical vascular supply and promoting accelerated healing and earlier rehabilitation" (Geissler 2001). Without proper healing, there is a high likelihood of re-injury and suboptimal healing. Even in optimal conditions, in which the wrist is immobilized for 4 months and the fracture heals properly, there can be a small notch remaining on the bone (Altinok *et al.* 2004). In this case, the fracture did not remodel completely and a notch is still visible.

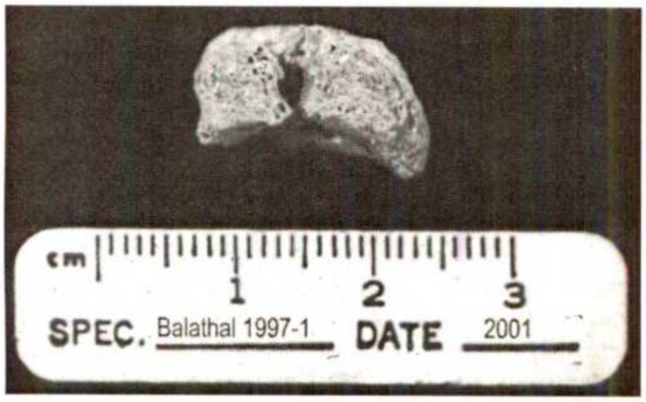

Fig. 7: BTL 1997-1 Left lunate, partially healed fracture

Individual 1999-3 suffered from a pelvic ring fracture of the left ischio-pubic ramus, sub-luxation of the left acetabulum and necrosis of the left femoral head (Figs. 8-9). The inferior ischio-pubic ramus is one of the most common sites for pelvic fracture in archaeological remains (Lovell 1997). This type of fracture (of the anterior wall) often results in instability according to the amount of ligamentous disruption and is commonly associated with hip dislocation (Wheeless Textbook of Orthopedics 2005). If activity is not suspended and the fracture is not immobilized, the femoral head will often become displaced and subluxation commonly results (Wheeless Textbook of Orthopedics 2005).

Generally, with pelvic ring fractures, there are two sites of injury (around the ring). Fracture of the anterior wall is also seen in association with either a sacro-iliac joint fracture or a fracture in the ilium at the opposite side of the pelvic ring. In cases where two fractures have occurred on one side of the pelvis, it is referred to as a

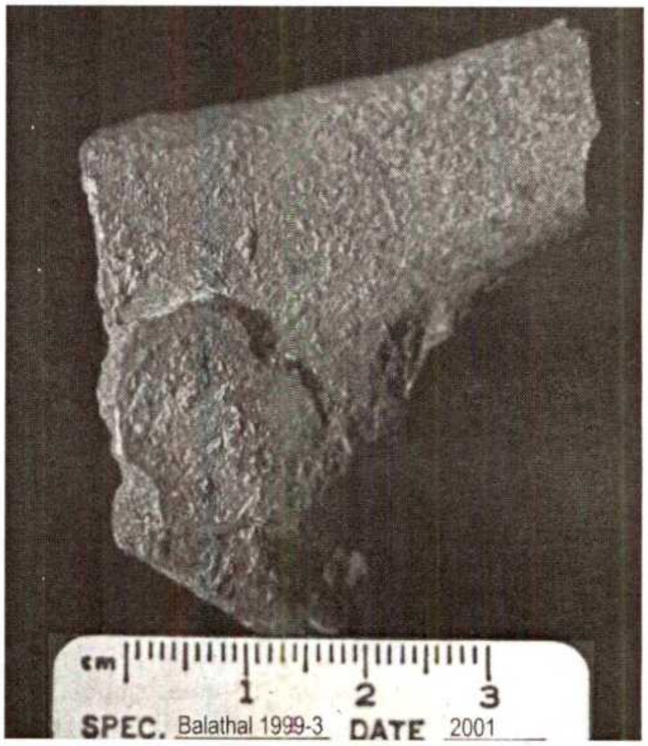

Fig. 8: BTL 1999-3 Left pubis fracture callous (ventral view)

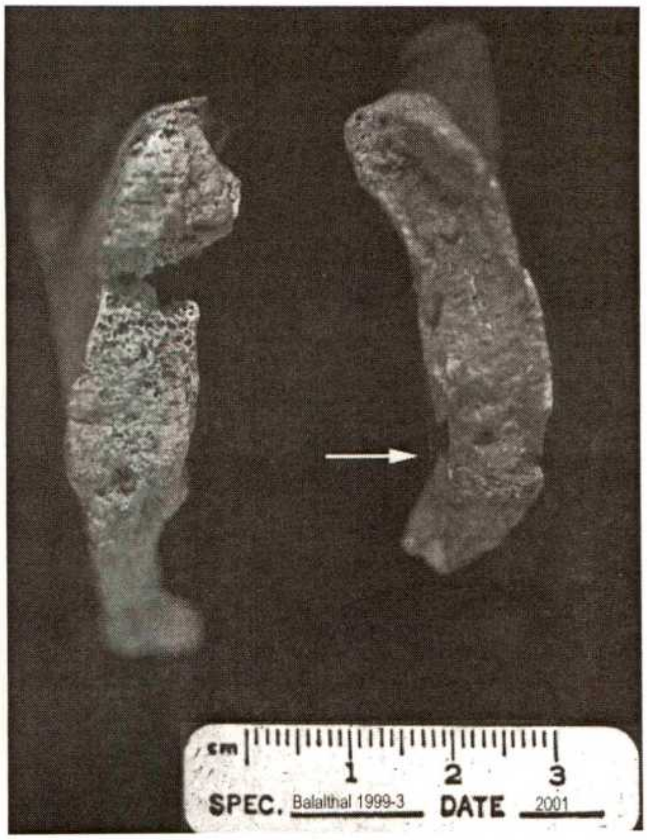

Fig. 9: BTL 1999-3 Left and right pubic ramus, medial view

Malgaigne fracture and direct blunt trauma is often involved. In this individual the pelvis is fragmentary and only the two pubes, the right acetabulum, and fragments of the iliac blade are available. There is no additional evidence of fracture on any of these fragments.

The anterior wall fracture demonstrates evidence of healing but the alignment of the bone is not perfect. The inferior pubic ligament normally provides stability to the pubic symphysis but if this ligament was damaged in the fracture event, was displaced due to the misaligned pubis, if pubic diastasis had occurred, or the joint was unstable due to frequent reinjury, degenerative joint disease in the symphysis is not a common result (Gamble-James *et al.* 1986). In this case the cortical bone at the pubic symphysis was eroded postmortem and thus is not visible.

Displacement of the ring may have caused the subluxation of the acetabulum. The femoral-acetubular joint was displaced and the femur was meeting the acetabulum on the posterior half of the lunar surface. This displacement occurred long enough prior to death to wear a new joint surface into the innominate. The necrosis of the femoral head is best explained by the malalignment of the joint, which may have blocked blood supply to the bone.

The pelvic fracture and dislocation of the femoral joint may have occurred due to direct blunt trauma, as from a fall, or it may have resulted from a stress fracture. This type of injury often occurs as a result of jogging and long distance running in modern clinical practice (Pavlov *et al.* 1982). There was no evidence of any infectious disease, metabolic or nutritional disturbance, osteoporosis, or other pathological conditions in the skeletal remains from Balathal. Excessive mechanical loading, accidental, and/or violent traumatic injury are the most likely causes of these fractures.

One individual (1999-2) had no pathological conditions expressed in the skeleton and one additional individual (1999-1) had only an incipient Schmorl's node in the cervical spine. For individual 1997-1 (a 40 year old male) degenerative conditions associated with heavy labour (such as lunate fracture, osteoarthritis of diarthrodial joints, Vertebral Osteophytosis, vertebral compression fracture, and subsequent spondylosis) were manifest in the skeleton. This individual was either involved in heavy labour for a long period of time or he was particularly susceptible to bone forming responses to stress and could be called a "bone former" (Watt 1997). For individual 1999-3 (a 30 year old female), the presence of a compression fracture in the thoracic region, ankylosing of several thoracic vertebrae, a well-healed pelvic fracture of the anterior wall, subluxation of the acetabulum and necrotic femoral head indicates that this individual suffered from a traumatic fall, possibly from a great height, many years prior to death and was given sufficient time and resources to enable healing.

Dental Pathological Conditions

Teeth are the most commonly recovered element in the excavation of human remains and as such they can be a crucial record of health, diet, and behaviour (Lukacs 1989; Alt *et al.* 1998). Unlike the more general information provided by skeletal lesions such as osteoarthritis, some aspects of dental pathology can be quite specific indicators of stress and other disturbances. Although Balathal is a small collection of only 5 individuals, there were a substantial number of skeletal and dental pathological conditions represented in these remains. Table 2 provides a summary of the pathological analysis by individual and by number and percentage of teeth. The following conditions were present: LEH, caries, secondary dentine formation, calculus, alveolar recession, hypercementosis, abscess and antemortem tooth loss (AMTL).

Linear enamel hypoplasia (LEH) is a developmental defect caused by metabolic disturbances during tooth crown formation that result in deficiencies of enamel thickness (Goodman and Rose 1990). These transverse, linear defects vary in appearance from a single, sharp, thin line across the enamel surface to a series of deep furrows

Table 2: Dental pathology

IND	n x/d	LEH		caries		second. dentine		calculus		alvrecess		hyper-cement		abscess		AMTL	
		x	d	x	d	x	d	x	d	x	d	x	d	x	d	x	d
97-1	3/10		2			3	6		10	16	16	1		2	1	13	6
97-2	0/4				2		1		2								
99-1	14/12			2	2	2		6							2		1
99-2	1/5	1	2					1	5								
99-3	7/14	2	2	2	4			6	8								
Teeth																	
#	25/45	3	6	4	8	5	7	13	25	16	16	1	0	2	3	13	7
%	12	13	16	18	20	16	52	56	64	36	4	0	8	7	52	16	
Individuals																	
#	5	3	3	2	4	1	1	2	2								
%	60	60	40	80	20	20	40	40									

resulting in an undulating enamel surface (Fig. 10), often referred to as a "washboard" (Hillson 1996). For the purposes of this research, the term LEH includes both thin striations and thicker, deeper, major growth arrest lines (Corruccini *et al.* 1985; Goodman and Rose 1990).

Over 100 stressors have been identified that can be sufficient to disrupt the secretion of enamel matrix by ameloblasts during the developmental period (Suckling 1989; also see review in Pindborg 1970: 75-210). These stressors include hereditary anomalies, trauma, systemic metabolic disturbances such as nutritional deficiencies, parasites, and certain systemic diseases that have significant metabolic effects, such as syphilis or tuberculosis (Suckling 1989; Pindborg 1982; Goodman and Rose 1990; Hillson 1996; Ortner 2002). Studies of non-human primates have revealed that defects can be caused by birth, parturition, and social and psychological stress (Guatelli-Steinberg 1998). Most defects in humans are thought to result from systemic metabolic disturbances such as malnutrition and infectious disease and LEH is thus considered a non-specific indicator of stress (Goodman and Rose 1990).

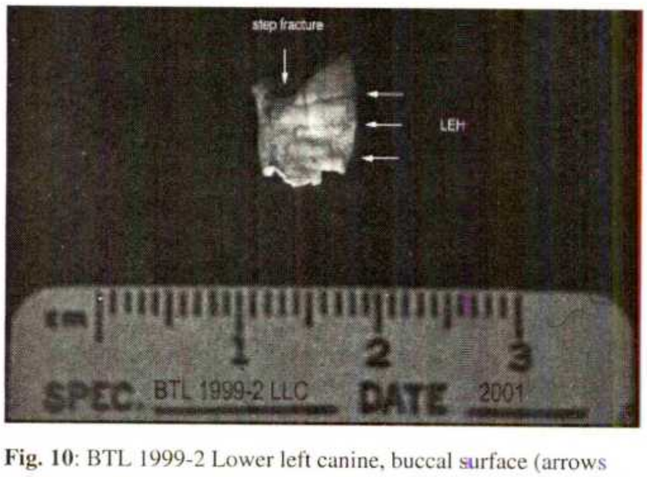

Fig. 10: BTL 1999-2 Lower left canine, buccal surface (arrows point to LEH and an antemortem fracture)

LEH records developmental disturbances from the prenatal period to 1 year in deciduous teeth and from birth to 6 years in permanent teeth. Anterior teeth, particularly the maxillary central incisors and the mandibular canines, are most commonly affected suggesting that these teeth may be more susceptible to growth disruption, perhaps because enamel forms more slowly in these teeth (Goodman and Armelegos 1985; Hutchinson and Larsen 1988; Condon and Rose 1992). Thus the period from 12 to 36 months will be more accurately portrayed in anterior teeth than in the first permanent molar. In addition, defects are more common in maxillary than in mandibular teeth (Goodman and Armelegos 1985; Hillson 1996).

The number and pattern of defects provides information about the frequency of stressors and whether they were cyclical, periodic, or rare events while the width and depth of defects represents the severity and duration of the stress (Blakey and Armelegos 1985; Suckling et al 1986; Hutchinson and Larsen 1988; Guatelli-Steinberg 2004). Because LEH is not always associated with Wilson Bands, macro-defects may represent a long-term stress with a minimum duration of weeks (Condon 1981). Location of the defect in relation to the CEJ also provides important information about the biological (or developmental) age at which the stressor occurred (Goodman and Armelegos 1985; Goodman and Rose 1990). However, because the anterior teeth are more sensitive to disruptions, the permanent teeth may represent the period from 6 to 36 months with more accuracy than later periods because the anterior dentition is still forming.

In fact the frequency of defects is highest within this age group. Initial peaks generally occur around 12 months of age and are often associated with weaning (Corruccini *et al.* 1985; Ubelaker 1992; Moggi-Cecchi *et al.* 1994; Webb 1995). An additional peak of defects commonly occurs in the 2-5 year period (Hillson and Bond 1997; Goodman and Armelegos 1985; Corruccini *et al.* 1985; Storey 1992; Blakey *et al.* 1994; Hutchinson and Larsen 1988) may be a function of developmental timing of anterior teeth, which are more susceptible to registering defects, or it could be related to the increased susceptibility of this age group to developmental disruptions (see discussion of sub-adult stature above; Hummert and Van Gerven 1983; Bogin 1988; Goodman and Armelegos 1985). Defects in the 18 months to 4 years category are unlikely to be due to weaning (Katzenberg *et al.* 1996). Defects in posterior teeth are less common in part because the rate of enamel formation is faster but also because these teeth form later in childhood (Goodman and Rose 1990). Defects in posterior teeth may be associated with particularly high levels of systemic stress including nutritional deficiencies (Hutchinson and Larsen 1990) and infectious disease (Kreshover 1942).

For the Balathal sample (Table 3), the defects most commonly occurred in the anterior dentition, with the canine being the most common site, a pattern that is frequently seen and may reflect an increased susceptibility to stress in the amelogenesis of these teeth (Goodman and Rose 1990). The cusp outline of the permanent canine crown is formed by 12-18 months and the crown completes formation at 54 months (4.4 years) (Moorrees *et al.* 1963b; Smith 1991). Timing cannot be estimated with any specificity for individual 1999-2 as the CEJ is missing for both canines present. The timing of defects in individuals 1997-1 and 1999-3 indicate stressors were most likely to disrupt development in the age range of 36-48 months. This pattern suggests that changes in dietary or environmental conditions for some individuals negatively impacted development during this age range.

Changes in diet or disease status could be related to cultural or dietary practices affecting children in this age range, or the interbirth interval and sibling competition for food or maternal attention. The lack of defects on other teeth forming during this period, such as the first molar, indicates that the stressors were not severe enough to impact the entire dentition. Individual 1999-3 was more impacted by this stress than individual 1997-1 either because the stress was more severe, of longer duration, or because this individual was more susceptible.

Analysis of dental caries (Fig. 11) can provide insights into diet in the sense that hunting and gathering populations, such as the Early Holocene samples from the Ganga plains (Mahadaha, Sarai Nahar Rai, and Damdama) often demonstrate low frequencies of caries and relatively higher frequencies of secondary dentine formation due to heavy attrition. Caries rates are higher in agricultural populations around the world due to the stick, processed diet that is high in carbohydrates (Cohen and Armelagos 1984). In addition, a pattern of sex dimorphic caries rates has been noted in many agricultural populations with females having higher frequencies. It is currently debated as to whether this disparity is due to the effects of pregnancy and associated changes in oral chemistry, eating habits, and increased frequency of vomiting or whether it is due to a sex based division of labour that provides an opportunity for an increase in snacking frequency among females during food preparation, or the combined effects of both hypotheses.

In the Balathal sample, 16% of maxillary and 18% of mandibular teeth were affected by caries in 60% of the individuals (n = 5). This caries rate is substantially higher than the rates for hunting and gathering populations in the Ganga plains but similar to other agricultural communities

Table 3: LEH timing and frequency (reported in mm from the CEJ)

	URI1	ULI1	ULC	LRI2	LLI2	LRC	LLC	Age of disruption
1997-1						2.81	3.05	~ 36 months
						4.70	4.51	~ 48 months
1999-2			3 defects present				3 defects present	CEJ dam
1999-3	5.03	5.48		2.12		2.80		~ 36 months

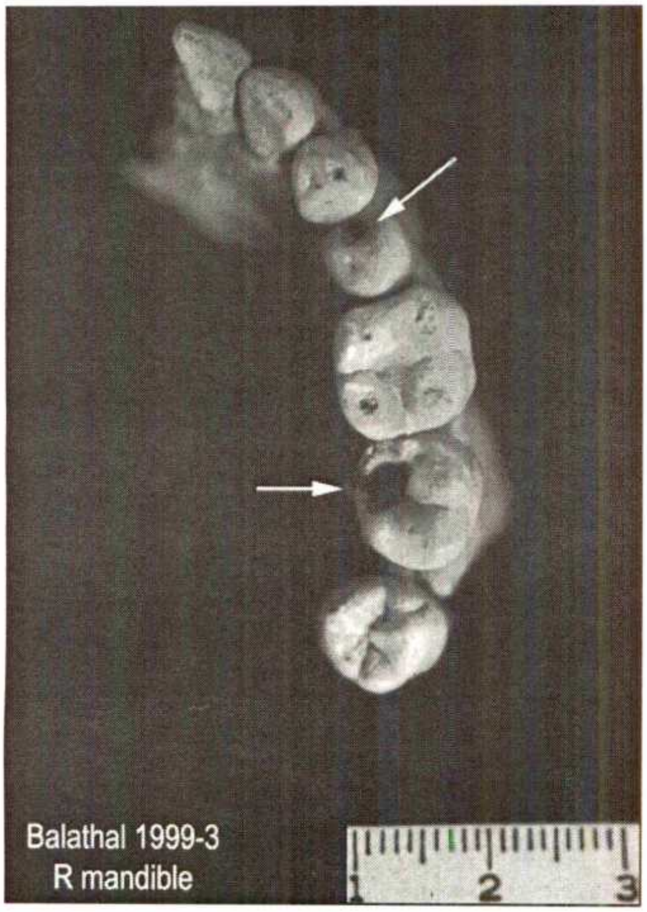

Fig. 11: BTL 1999-3 Right mandible, occlusal view (arrows point to carious lesions)

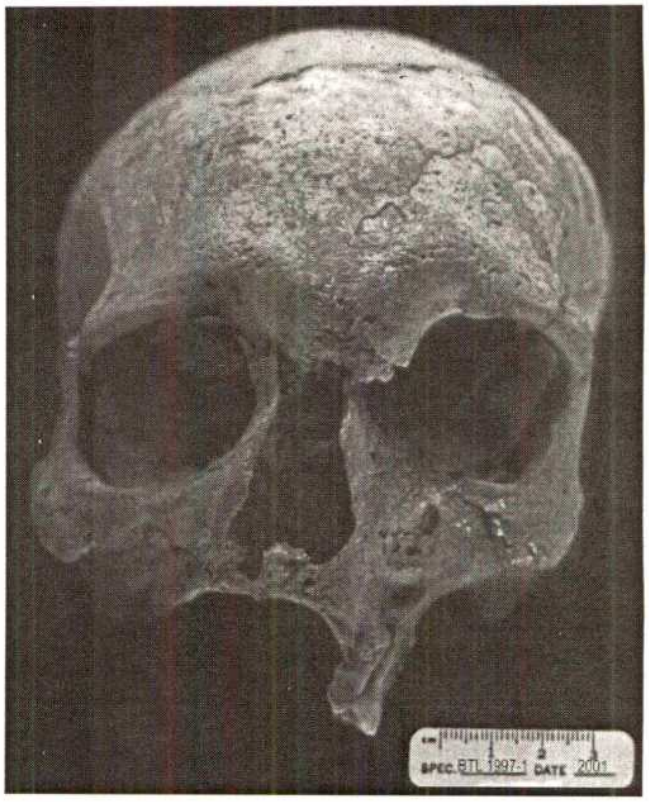

Fig. 12: BTL 1997-1 Skull (ventral view)

in South Asian prehistory (Table 4). A rate of 17.1% of all teeth is not unusual for populations practicing agriculture as their main means of subsistence. The level of enamel hypoplasia (12-13 % in maxillary and mandibular teeth) is fairly low although 60% of the individuals in this sample were affected. Antemortem tooth loss was relatively common in this sample in comparison with other agricultural populations (Figs. 12 and 13). These individuals had a high prevalence of abscess and AMTL in addition to the high caries rate, which combined to cause tooth loss of almost 30% of the teeth available for this sample (Fig. 14). As the sample from Balathal is relatively young, with an average age of death of 34, this is an extremely high level of tooth loss and the majority of the teeth were lost years before death allowing enough time for complete alveolar remodelling in the majority of cases.

Table 4: Comparative Statistics for Dental Pathology in Adults from South Asian Samples (teeth affected)

Statistics	**Langhnaj**	**Lekhahia**	**Sarai Nahar Rai**	**Mahadaha**	**Inamgaon**	**Balathal**
Skeletons N	14	19	14	32	5	5
Dentitions n	7	5	5	16	3	5
Teeth	113	112	114	261	28	70
Avg teeth/ind	16	22.4	22.8	17.4	24	14
Abscesses	2 (1.8%)	5 (4.5%)	0	9 (3.5 %)	0	5 (7.1%)
Caries	9 (8.0%)	1 (0.9%)	0	3 (1.2 %)	4 (14.3%)	12 (17.1%)
AMTL	15 (11.7%)	0	0	35 (11.8 %)	1 (3.6 %)	20 (28.6%)

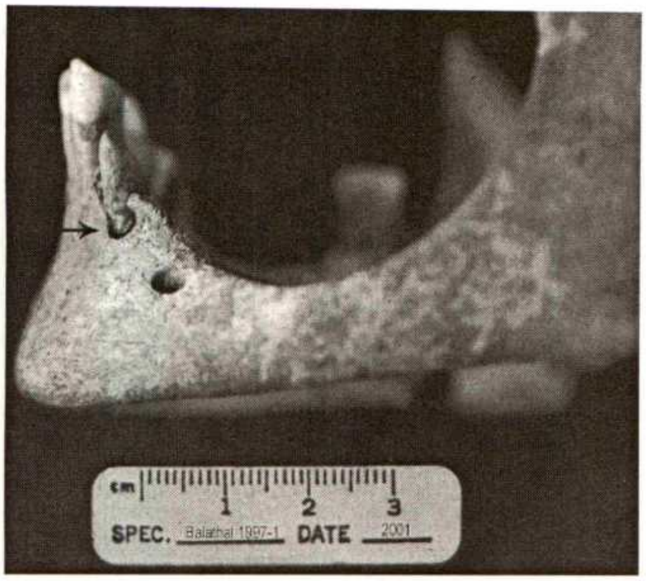

Fig. 13: BTL 1997-1 Left lateral view of the mandible (arrow points to periapical abscess, which should not be confused with normal foramina such as the opening just below the abscess)

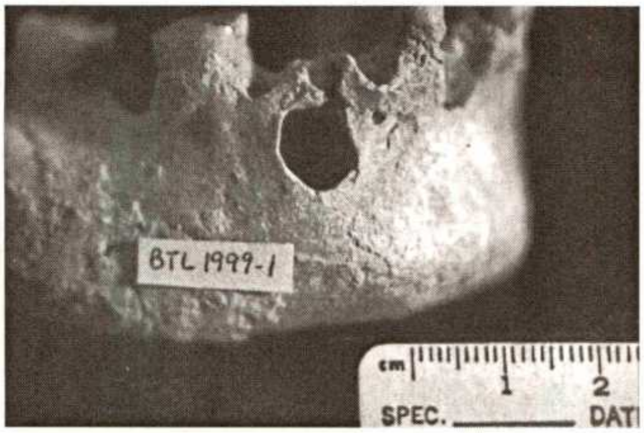

Fig.14: BTL 1999-1 close up of periapical abscess near roots of P3 and P4 (right lateral oblique view)

Odontometrics will be provided in full in the excavation report and are not reported here. Summed crown areas were not taken as there were too many teeth missing for each individual. However, asymmetry in antimere tooth dimensions was evaluated as a measure of developmental stress. Crown areas for the right and left antimeres were compared using a Wilcoxon Sign Ranked test for non-parametric samples because the sample sizes were small (Table 5). Only mandibular dentition could be evaluated for individual 1997-1. Individual 1999-3 had one set of antimeres from the maxillary dentition, which was combined with 5 sets from the mandible for this analysis. The results of this analysis suggest that developmental stress experienced during late infancy and early childhood did not result in fluctuating odontometric asymmetry.

Table 5: Asymmetry of crown area (Wilcoxon Sign Ranked Test for 2 related samples)
(significant differences in bold, alpha = 0.05)

Individual	Z-score	p-value
1997-1	1.461	0.144
1999-3	1.153	0.249

Discussion

In India today, the majority of corpses belonging to Hindu communities are cremated, preferably at the burning *ghats* along the banks of the Ganga at Varanasi. According to volunteers at the burning *ghats*, there are five classes of deaths in modern India for which the individual is sometimes not cremated: children under the age of twelve, pregnant women, lepers, victims of *jadu* (magic), and *sadhus*. Children under twelve are not cremated because they are considered innocents who have not yet been fully integrated into the society. Pregnant women, whose bodies house infants, are also not cremated. Lepers, infants, and pregnant women may be buried or placed in the Ganga River. These proscriptions against cremation in modern practice are certainly reminiscent of the demographic profiles for Deccan Chalcolithic sites such as Inamgaon, Nevasa, and Daimabad, in which infants and children under 12 years of age predominate (90% of the collection of over 300 individuals is under five years of age).

Hindu ascetics and victims of *jadu* (magic) are also a distinct category in terms of mortuary treatment because they are considered homeless spirits. Several men who work at the burning *ghat* preparing bodies for cremation stated that a victim of magic is to be floated onto the river on a bier with his name and address attached. The Hindu ascetics, those who have renounced their ties to the family, the home, the village, and to the material world, are also not cremated upon their death. The corpses of some ascetics are disposed of through *samadhi* burial, by which they die (or are subsequently positioned) in a meditation posture and they are interred in this position. Others undergo water *samadhi* in which they are sunk to the bottom of the Ganga using a heavy weight. The seated posture, with hands on knees, is not restricted to ascetics or religious figures, but can also be found with the death of a male head of household (*grihasti*).

No regular burial ground was uncovered at the site of Balathal during five seasons of excavation. Only these five adult individuals were recovered from this large agrarian village. Two of these individuals were recovered from the B Phase of the Chalcolithic (4400-3800 BP) deposit and three additional individuals were recovered from the Early Historic layers (2200-1800 BP). The individuals who were buried at Balathal all represent some form of mortuary bias and possibly a cultural category of individual or manner of death that required special mortuary treatment. Individual 1999-2 was buried in a careful and deliberate style, positioned in a manner quite similar to the *samadhi* posture associated with males in the *sannyasi* (ascetic) life stage. It is difficult to estimate age for this individual as the pelvic indicators are not visible and age must be based on dental attrition and lack of degenerative joint disease. Similarly this individual is thought to be male but the most reliable indicators are not visible. There was no indication of any skeletal pathological conditions in this individual.

Individual 1997-1 was an older adult male that had suffered the stresses of prolonged and rigorous labour, as evidenced by his advanced state of degenerative joint disease in many of the diarthrodial joints as well as the spine. This individual also suffered from several severe stresses during the developmental period. The timing of these childhood stresses indicates that stress levels were sufficient to impact growth and development around three years of age. This individual also suffered a lunate fracture probably as a result of a direct blow to the ulnar aspect of the wrist or forceful hyperextension, such as in a fall on outstretched hand. This man was not carefully and deliberately buried but was found in a haphazard posture suggestive of careless dumping of the carcass within the cow dung deposits found in the fortified area.

The two individuals from the Chalcolithic context were females in middle to older adult age categories. Individual 1999-1 was in excellent skeletal health and had not performed a great degree of strenuous labour as represented by degenerative joint disease and musculoskeletal markers. This individual was also the only skeleton in this sequence that showed evidence of careful placement, with the body arranged in a flexed posture, and the presence of a single pot near her head. In contrast, Individual 1999-3 was a middle aged female that had suffered from serious injury and subsequent degenerative joint diseases that would have left her partially disabled. This individual also suffered from developmental stress severe enough to disrupt enamel formation around the third year of life.

Thus all of the individuals buried at Balathal could perhaps represent culturally constructed categories of individuals that were subject to differential mortuary treatment, while the majority of deaths were treated in a manner that left no trace of the individual behind. This collection is remarkable in the pathological conditions present, evidence of differential burial practices, and potentially for evidence of social hierarchies at least in mortuary treatment. The two individuals with no evidence, or limited evidence for work related or traumatic pathology, demonstrated deliberate burial postures and grave goods. The two individuals that had evidence of traumatic injury and work related stress were buried in unceremonious postures and without burial goods. While there is only a limited amount of evidence because of small sample size, these relationships do not conflict with expectations one might develop based on an understanding of social stratification in Vedic practice, practices that were established in this region prior to the third millennium B.C.

The dental remains from this small collection provide additional evidence concerning dietary practices and the heavy reliance upon cariogenic foods associated with agricultural practice. A high frequency of caries meets expectations for populations relying on agriculture and a few staple foods that are high in carbohydrates, heavily processed, and sticky (Lukacs 1989). The high caries rate is also associated with a high rate of alveolar abscess and antemortem tooth loss. Calculus and heavy attrition were not an issue for this population. In addition, the dental pathological profile showed evidence for developmental stress around 3 to 4 years of age. These growth disruptions could be related to infant feeding practices, socio-sanitation issues, and/or interbirth interval and allomothering by older siblings. This stress did not result in fluctuating odontometric asymmetry but may have contributed to short adult stature, which is within the range expected for Chalcolithic India.

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Palas Leaf Impression on Burial Pots from Chalcolithic Utawad, Madhya Pradesh

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Abstract

Excavations at the Chalcolithic site at Utawad revealed two cultural phases. Phase II revealed the evidence of non-sepulchral symbolic pot burials. The significance of these burials lies in the *palas* leaf impression found at the base of the burial pots. Since the *palas* leaf is mentioned in the Satpatha Brahmana, Srauta and Asvalayana Grhya Sutra, an attempt has been made to interpret it in the context of Chalcolithic burials at Utawad.

Introduction

The Chalcolithic site of Utawad (22° 4' 25" N; 75° 0' 7" E) is located in Barwani tehsil of district West Nimar, Madhya Pradesh. It lies about 400 m from the right bank of Sosar nallah, a tributary of the river Narmada. The site is located about 800 m north of the present village of Utawad, which can be approached by a rough cart track from the village of Borlay via Pipri. The site was chosen for excavation in 1994-95 with a view to ascertaining the nature of the Chalcolithic culture in a region of which very little is known, leaving aside the excavations at Navdatoli (Sankalia *et al.* 1971). The excavations at Utawad form a part of the salvage archaeological investigations related to the submergence area of the Sardar Sarovar Dam on the river Narmada. They were carried out by the Prehistory Branch of the Archaeological Survey of India under the direction of the first author.

The Chalcolithic settlement at Utawad covers an area of around 1500 m^2, and forms an isolated crescent-shaped mound oriented east-west, rising to a height of about 144 m AMSL. The habitation deposit has a maximum thickness of about 0.5 m and overlies a 0.8 m thick deposit of black cotton soil. Underlying this is the Narmada alluvium which is yellowish *kankary* silt. The mound is considerably disturbed due to recent ploughing activities.

Archaeological Evidence

The excavations at Utawad revealed a Chalcolithic culture which was divided into Phases I and II on the basis of structural evidence and other associated cultural finds.

Phase I is characterised by the occurrence of dwelling pits, whereas Phase II has yielded structural remains which include a sunken floor with a fireplace, a sunken floor without a fireplace, and a floor at the surface level. Dwelling pits are completely absent in Phase II. The ceramic industry of Phase I comprises mainly white painted Black-and-Red ware, Black on Red ware and associated Red ware, which also continues in Phase II. However, the frequency of painted sherds in Phase I is more than that in Phase II. Besides this, certain painted designs on Red ware found in Phase I are similar to those seen at Pipri, and which are uncommon in Phase II. Pipri, another Chalcolithic site, about 1.5 km southwest of Utawad was also excavated in 1994 by the first author. Cultural evidence seen at Pipri is similar to that of Phase I at Utawad.

Ceramic varieties which characterise Phase II include mostly chocolate-slipped Red ware jars with splayed out rounded rims and a ring base, features which are completely absent in Phase I. Other cultural material such as microliths, large stone artefacts of quartzite, varieties of beads, (mostly micro-beads of paste and steatite, etc.) are common to both phases.

A significant discovery made at Utawad is that of the non-sepulchral symbolic pot burials from Phase II. These burials lie within the habitation area as seen at the Deccan Chalcolithic sites. The unique feature which differentiates these burials from other symbolic pot burials commonly found at Chalcolithic sites, are *palas* leaf impressions on the base of the burial pots. Keeping this unique feature in mind, an attempt has been made here to understand the probable symbolic meaning of the *palas* leaf in burial customs during the Chalcolithic period.

As the site is badly disturbed, only two such complete pot burials could be recovered from the excavations. Besides this, a total of 26 fragments of the base of burial

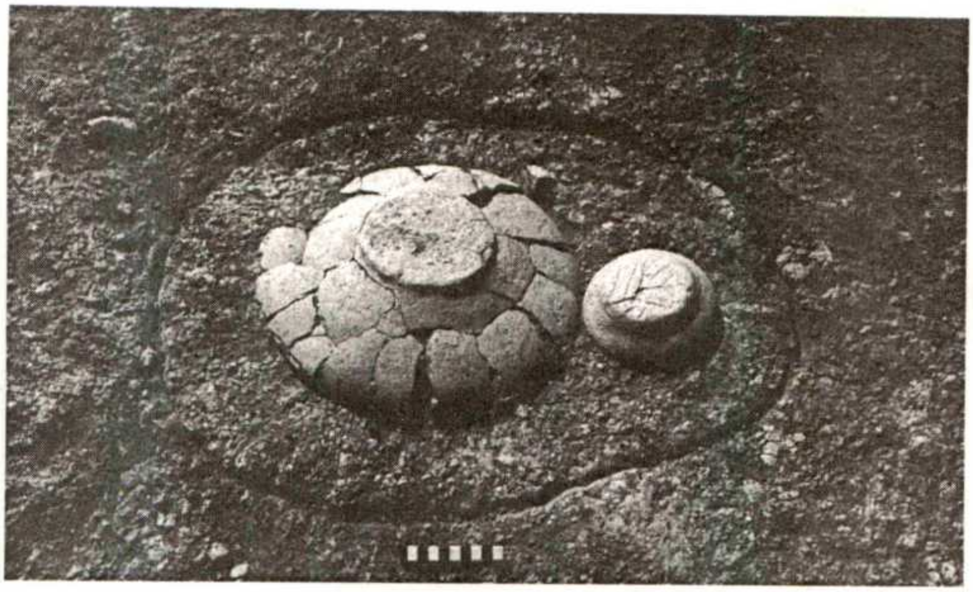

Fig. 1: Utawad: in situ burial pots with *palas* leaf impression (Trench A2, Quadrant 4)

jars with *palas* leaf impressions have been collected both from the surface and from within the excavations.

Burial No. 1

Burial No. 1 (Fig. 1) was found towards the north of a sunken floor (Trench A2, Quadrant 4) of Cutting–I area at a depth of 34 cm. The burial pit was oval in shape and oriented north-south, measuring 60 x 35 cm. It contained two inverted pots. The main burial pot is a burnished Red ware jar of thick fabric, coarse texture and ill fired. This jar was badly crushed due to the sediment load. However, the other inverted pot lying 8 cm north of the main jar is better preserved, and was found intact. It is a *lota* (vase) shaped medium-sized pot with the same fabric and texture seen in the main jar. This *lota* shaped pot bears a *palas* leaf impression at its base. In the process of creating the impression, the leaf was evidently folded, and this is clearly visible. A small quantity of ash was found in both pots.

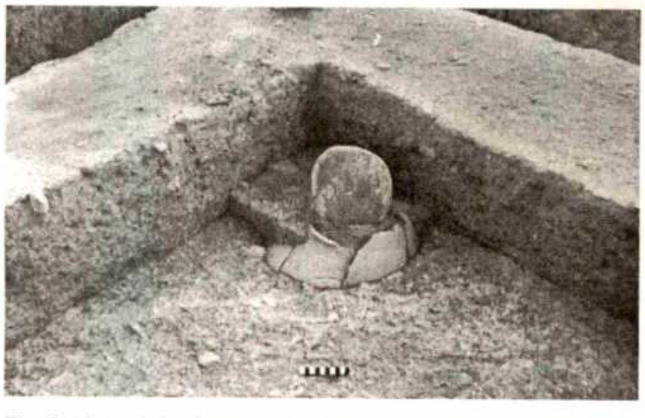

Fig. 2: Utawad: in situ burial pot (Trench XA1, Quadrant 3)

Burial No. 2

This (Fig. 2) was found in Trench XA1, Quadrant 3 of Cutting–I area, and was located between two sunken floors at a depth of 65 cm. The burial pit was circular in shape, measuring 75 cm in diameter. This pit contained a medium-sized ill-fired Red ware jar (Fig. 3) of thick fabric and coarse texture. It was burnished on the upper half of the exterior surface. It was also badly crushed due to the overhead sediment load. After burying the jar in the pit, the burial was marked by positioning a quartzite cobble on top of it. This is a rolled quartzite cobble, 22 x 18 x 5.5 cm in dimension, oriented east-west and placed in an almost erect position, inclined about 35° south. The jar contained some charcoal, over which a basalt stone (26 x 22 x 13 cm in dimension) was placed. The base of the jar bears a *palas* leaf impression (Fig. 4).

The *Palas* Tree: The Flame of the Forest

Butea monosperma (Lamk) or *Butea frondosa*, popularly known as *palas* is widely found in the subcontinent in dry deciduous forests at up to 1200 m elevation, as also in open areas. It is also common that the forest types are sometimes classified on the basis of the occurrence of the *palas* tree. Because of its attractive flowers, it is described as the 'flame of the forest'. The *palas* leaf consists of three leaflets; the central or the terminal, being oval shaped is considerably larger than the lateral ones, which are

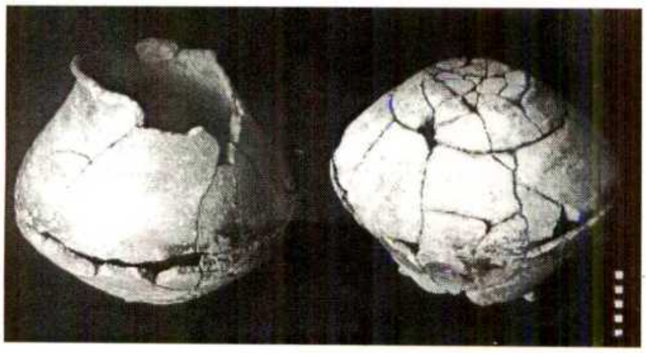

Fig. 3: Utawad: Burial pot (Trench XA1, Quadrant 3)

somewhat oval in shape. The vein pattern of the central leaflet differs slightly from the lateral ones. The mid-rib in the central leaflet emanating from the stem in the form of a butt, is at first straight and gradually becomes thinner at the apex dividing the central leaflet into two symmetrical halves. The veins originating from the mid-rib in opposite directions form an angle and curve towards the end; whereas in the case of lateral leaflets the mid-rib does not divide the leaflets into two symmetrical halves. Further, the veins in the lateral leaflets start displaying curves immediately after emanating from the mid-rib. In all the leaflets the veinlets are registered within two large veins in a horizontal fashion and thus form a web. The leaf is dorso-ventral and thus receives direct sunlight on the upper surface, and is thus glossy in appearance; whereas the lower surface is coarse; and the vein pattern is seen in relief.

The leaf impressions found on the bases of the burial urns correspond to the structure of the central leaflet of the *palas* leaf. The minute details of the vein pattern and deep impression of the leaf on the pots suggest that the impressions were made when they were leather hard. Further, the vein pattern noticed on all the pot bases suggests that only the central leaflet of the *palas* leaf was used. On one of the pot bases, the impression of the central leaflet rises towards the body portion. This supports the fact that these were intentionally created impressions. Further, the detailed impression of vein patterns and the sharpness of the vein impressions on the pots also suggests that the leaf impressions were deliberate. These burial pot bases with leaf impressions were treated with lime wash.

Palas, a sacred tree, is mentioned in ancient literature in connection with funeral rites. The Rigveda (X. 27. 14) while glorifying the greatness of God, mentions Him as *apalasah* or 'Beyond Death' (Saraswati 1974: 386). Here *palas* signifies 'death' and was associated with death or death rites. The Atharvaveda (III. 5. 2) mentions *palas* as *parna*, a symbol of royalty and considers the central leaflet of the *palas* leaf as sacred (XVIII. 4. 53) and to be used in rituals (Stutley and Stutley 1977: 221). Further the same text also considers *palas* wood as sacred, and to be used for making amulets ensuring victory over rivals (probably victory over evil spirits) and for the attainment of wealth and longevity, etc. (Stutley and Stutley 1977: 221).

The Satpatha Brahmana (*Kanda* 13, *Adhyaya* 4, *Brahmana Kandika* 4-5) mentions that *parna* or *palas* wood comprise six out of 21 sacrificial stakes or *yupa*

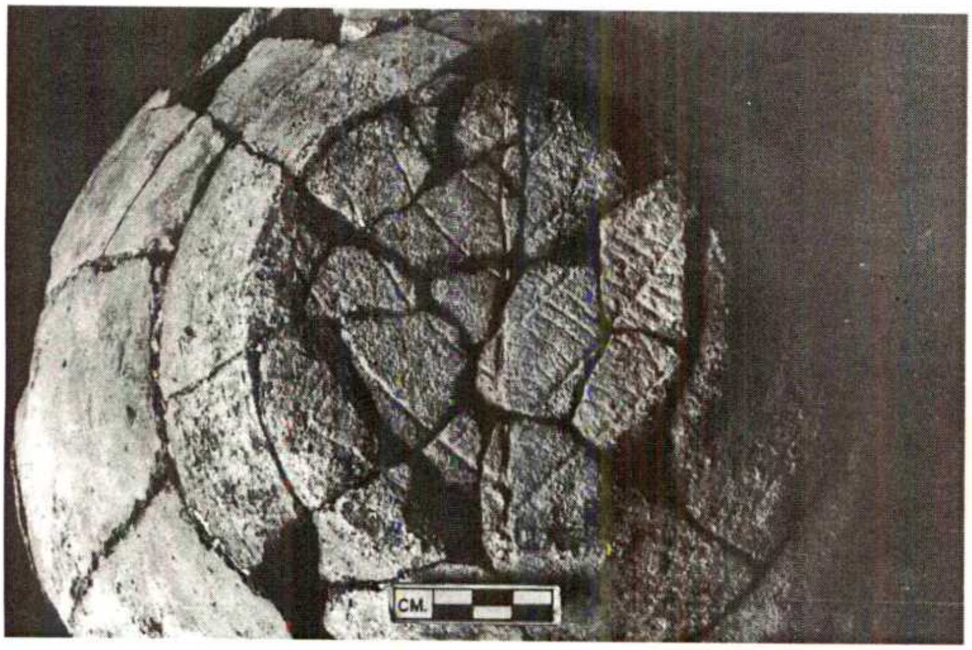

Fig. 4: Utawad: Close- up view of *palas* leaf impression on bottom of the burial pot (Trench XA1, Quadrant 3)

(Stutley and Stutley 1977: 221). The same text (*Kanda* 2, *Adhyaya* 6, *Brahmana Kandika* 2 and 8) also mentions that the sacrificial oblation is offered on the central leaflet of the *palas* leaf as this is considered truly to be the 'Brahmana' or 'priesthood' (Stutley and Stutley 1977: 221). Further the Satpatha Brahmana and the *Srauta* work of Katyayana mention that the *palas* tree is offered in *pitrimedha* or post- cremation burials (Shastri 1966: 30-37). If a person died in a foreign country or if the bones of the dead could not be recovered, a figure is to be made with 360 leaves of *kusa* grass or with the same number of *palas* leaves or an equal number of twigs of *udumbara* which represent the different parts of the human body. This was then burnt, a ritual known as *kusaputtalikadaha* (Shastri 1966: 36).

The Asvalayana Grhya Sutra (*Adhyaya* 1, *Kanda* 12, *Sloka* 1 and 4) which mentions the *Chaitya Yajna* and states that the sacrificer should make the *Chaitya* an offering prior to the *svistakrt* offering. If the *Chaitya* is at a distance, the offering is sent through *palasaduta* or a messenger (Dange 1985: 78-79). Here *palas* denotes the medium for carrying a sacred message, and the person who carries the sacred message is called *palasaduta*.

Mention may be made of the current rites associated with death in Orissa. Here, on the 10th day after the death of an individual, the spirit of the deceased is offered *pinda* on a partly torn *palas* leaflet. In this case, *palas* is considered to be a messenger who carries *pinda* to the departed soul. In the *Pola* festival observed in Maharashtra, *palas* is used to drive away evil spirits. Further, the house is considered purified after symbolically whisking it with a *palas* branch.

Thus ancient literature and current traditions clearly indicate that the *palas* is considered sacred, and it plays a significant role in various rituals, in particular as related to death. In the light of these observations, the significance of *palas* leaf impressions at Utawad can be appreciated. This is one piece of archaeological evidence which corroborates references in ancient literature, and which pushes back traditions associated with the *palas* leaf to the Chalcolithic.

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A Study of Site Catchment Analysis of Gilund: a Chalcolithic Settlement in the Banas Basin, Rajasthan

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Abstract

Site catchment analysis helps us in understanding the level of technological development of a society by reconstructing the interrelationship between man and the environment. It studies the relationship between technology and natural resources lying within the catchment area of an archaeological site. Catchment area is defined as the area exploited by a population for its natural resources and which lies within a reasonable walking distance from the site. In this paper, a study of site catchment analysis has helped in understanding Gilund as an agro-pastoral site which had flourishing trade contacts with other sites within and outside the 10 km catchment area.

Introduction

Site catchment analysis is the study of the relationship between technology and natural resources lying within the economic range or catchment area of an archaeological site (Higgs and Finzi 1970). Catchment area is the area exploited by a human population for its natural resources and which lies within a reasonable walking distance from the site. This walking distance has been assumed to be around 5 km in the case of agricultural societies and 10 km in the case of hunting-gathering societies based on ethnographic work. In this paper, a study of site catchment analysis has helped in understanding Gilund as an agro-pastoral site which had flourishing trade contacts with other sites within and outside the 10 km catchment area. Although a number of studies have been done in different parts of the world; in India work on site catchment analysis is still in its infancy. R.S. Pappu and M.K. Dhavalikar (Pappu 1988) at Inamgaon initiated the study of site catchment analysis in India. Other such studies are by V.S. Shinde and R.S. Pappu at Daimabad (1990), and by R.S. Pappu and V.S. Shinde (1990) in the Central Tapi basin.

The Study Area

The study area is situated in the Rajsamand district of Rajasthan. It includes the Ahar culture site of Gilund and its catchment area. The study area occurs within a radius of 10 km around the site. Gilund is located on the right bank of the Banas River, about 75 km northeast of Udaipur. The area is drained by the Banas river system. A few Ahar culture sites were excavated, including Ahar (Sankalia *et al.* 1969), Balathal (Shinde, 2000), Gilund (IAR 1959-60 and Shinde *et al.* 2001-02), and Ojiyana (Meena and Tripathi 2001). These studies have brought to light a Chalcolithic culture using painted and wheel-made ceramics, specialising in a blade/flake industry, with the use of copper and subsistence based on hunting, agriculture and pastoralism.

Aims and the Methodology

The following aims were set forth to conduct the site catchment analysis at Gilund:

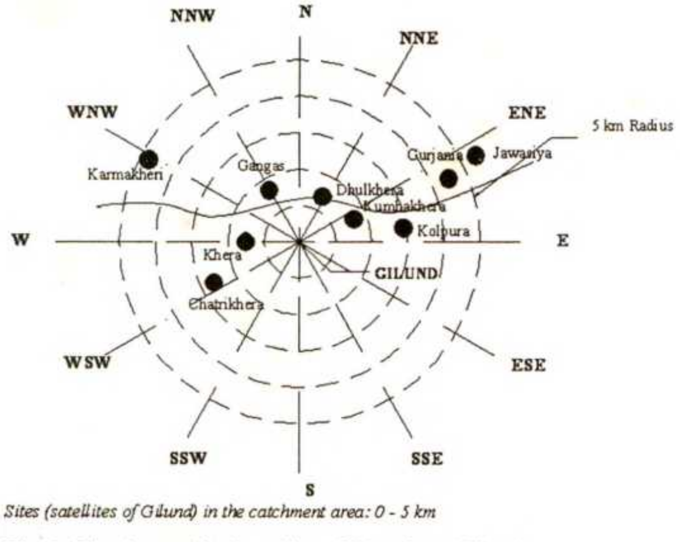
1. Study of the kinds of raw materials exploited by the Chalcolithic people of Gilund within a radius of 10 km, which thus determines the reasons for location of the site in this particular environmental niche.
2. Identify the finished products manufactured at the site and/or determine what raw materials were processed at the site.
3. Identify the objects obtained through trade and determine the kind of contacts and the regions with which such contacts were maintained.
4. Determine the subsistence pattern of the people taking into consideration site location and artefact types.
5. Evaluate the relationship of Gilund with sites found within a radius of 10 km.
6. Reconstruct site hierarchy, and functional analysis of the site of Gilund in relation to the sites found in the catchment area.

Initially survey maps were consulted and the area around the site was divided into 5 km and 10 km concentric circles denoting the exploitation territories used by the Chalcolithic people. Following this, a survey of the entire area falling within a radius of 5 km and 10 km was conducted on foot in order to determine the sources of raw materials and to locate any other site present in the vicinity. An analysis and classification of the raw material resources available in the catchment of Gilund was conducted. Classification and analysis of materials obtained from newly discovered sites or satellite settlements was also conducted. A comparative study of materials from satellite settlements with those found at Gilund was completed. Data from the catchment area was compared with that from the site. Further an analysis and classification of the excavated materials was done to investigate artefacts produced at the site and to compare these with those obtained from other sites and regions. Environmental changes were also taken into consideration. Detailed documentation and mapping of resources in the catchment area was done.

Results

In the course of this survey a total of 28 sites were located (Fig. 1). Of these, four are Mesolithic sites.

1. Chatrikhera IV is a Chalcolithic and historical site located 2.8 km southwest of Gilund. The height of the Chalcolithic habitation deposit is 3 m. The extent of the mound is 7 m. This site is located inside the village of Chatrikhera. The village is surrounded by fertile lands as well as those suitable for pasture. This site was an agro-pastoral settlement of the Chalcolithic people of Gilund.



Sites (satellites of Gilund) in the catchment area: 0 - 5 km

Fig. 1: Sites located in the radius of 5 km from Gilund

2. Chatrikhera I is a Mesolithic/Chalcolithic site. It is located ½ km south of the Chalcolithic site. This site was utilized by Chalcolithic people to exploit land suitable for pasture situated around it.
3. Chatrikhera II is a Mesolithic site located next to Chatrikhera I. It was a habitation site. It was also established for use of the surrounding land for pasture.
4. Chatrikhera III is a Mesolithic site located a few metres south of Chatrikhera I and II. This site was also utilised by Mesolithic people for exploiting pasture land.
5. Chatrikhera V is another Mesolithic/Chalcolithic mound located ½ km to the north of the Chalcolithic mound situated inside the village. This was utilised by Chalcolithic people as a pastoral site.
6. Chatrikhera VI is a Mesolithic manufacturing site located next to Chatrikhera I and II. It measures 100 m (N-S) by 55 m (E-W). The site is littered with debitage and tools of quartz and chert.
7. Dhulkhera is a Chalcolithic site. It is situated at a distance of 1.5 km north northeast of Gilund. The site of Dhulkhera is a small mound measuring 54 m (E-W) and 38 m (N-S) m and has a 1 m thick deposit. It appears to have been a camp site which manufactured lithic tools for the site of Gilund.
8. Gangas is a multicultural site, which has both Chalcolithic and historical deposits and is located at a distance of 4 km north northwest of Gilund (Fig. 2). It measures 107 m (N-S) by 56 m (E-W) with a 2 m thick habitation deposit. The mound is surrounded on all sides by land suitable for both pasture and agriculture. It was an agro-pastoral settlement of the people of Gilund.
9. Gurjaniya is a Chalcolithic site located at a distance of 4 km east northeast of Gilund (Fig. 3). This site is situated on the left bank of the Banas. Fertile agricultural lands surround this site. Gurjaniya was definitely

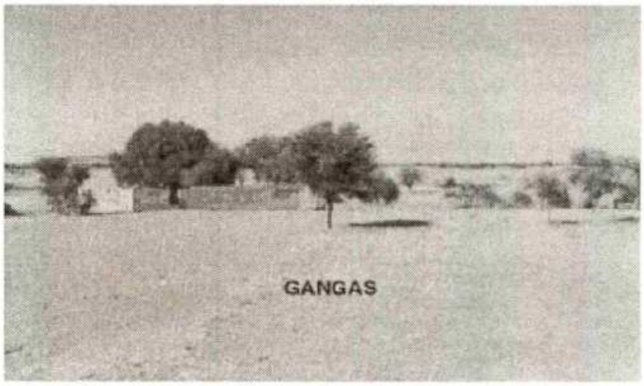


Fig. 2: Site of Gangas

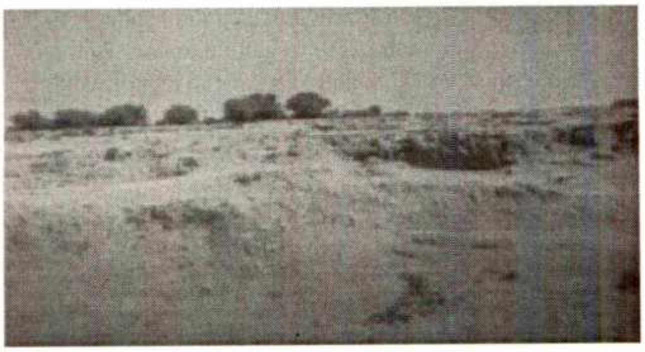


Fig. 3: Site of Gurjaniya

a farmstead settlement of the people of Gilund. It is spread over an area of 1 ha.

10. Jawasiya is a Mesolithic site located at a distance of 5 km east northeast of Gilund. It is a sand dune site and is located on the left bank of the Banas River. The height of the mound is 3 m. This site can be identified as lithic tool manufacturing site of Mesolithic people as a large quantity of microliths and debitage were found here.
11. Karmakheri is a Chalcolithic site located 5 km west northwest of Gilund. The site measures, 81 m (E-W) by 49 m (N-S). The mound rises 1.30 m above the surroundings. This seems to have been a farmstead of the Chalcolithic people as it is surrounded by fertile lands.
12. Khera is a Chalcolithic site located 1.5 km to the west of Gilund and on the right bank of the Banas River. This site measures 45 m x 75 m and was a farmstead of the site of Gilund as it is situated amidst fertile lands.
13. Kolpura is a multicultural site located at a distance of 3 km east of Gilund. It measures 70 m (N-S) by 60 m (E-W) and comprises habitation deposits. The height of the mound is 3 m. Surrounded by fertile lands it was a farmstead settlement of the Gilund people.
14. Kumhakhera is a Chalcolithic site located at a distance of 1.5 km east northeast of Gilund. The habitation deposit is 2 m. The site of Kumhakhera measures 100 m (E-W) by 75 m (N-S). This site is surrounded by very fertile lands. It was a farmstead of the site of Gilund.
15. Arni is a Chalcolithic settlement located 7.5 km to the northeast of Gilund. This site measures 49 m (N-S) by 27 m (E-W). It has a habitation deposit of 1 m. This site is also surrounded by very fertile lands and was a farmstead settlement.
16. Aloli is a Chalcolithic site. It is located at a distance of 10 km northeast of the site of Gilund. It is a small mound measuring 22 m (E-W) by 20 m (N-S) and with a habitation deposit of 1.5 m. This could have been a herding unit of the Chalcolithic people for exploiting lands suitable for pasture.
17. Bethumbi is situated 8 km northwest of Gilund. This was an agro- pastoral settlement of the Chalcolithic people of Gilund as is evident from the agricultural and pastoral lands around it.
18. Champakheri is a Chalcolithic site located 9 km to the west of Gilund. There are two small mounds located ½ km to the southwest of the village of Champakheri. The mounds are separated by an area 49 m (N-S) by 30 m (E-W). The site is surrounded by pasture land. It was a herding unit of the Chalcolithic people of Gilund.
19. Damana Dam is situated 8 km southeast of Gilund and in the dam of Damana. This site is also surrounded by pasture land. It was a herding unit of the Chalcolithic people of Gilund.
20. Gandrop is at a distance of 10 km northeast of the site of Gilund. The area of this site is around 0.75 ha. This site would have been a farmstead as is evident from the presence of fertile land around.
21. Ganeshpura is a multicultural site, which has both Chalcolithic and Historical deposits. This is situated 7 km southeast of Gilund. The area seems to be of 2 ha (approx). The height of the mound (habitation deposit) is 4 m (approx). This site was a farmstead of the site of Gilund as it is situated amidst very fertile lands.
22. Gopalpura is situated 8.5 km northeast of the site of Gilund. This could be a herding unit as indicated by the presence of a large pasture area full of small shrubs. Some Mesolithic pottery was also found here.
23. Jashma is a multicultural site, which has a Chalcolithic and historical deposit. It is situated at a distance of 9 km southwest of Gilund. It is spread over an area of 4 ha (approx) and has a habitational deposit of 5 m. The soil, *lal mitti*, is very fertile. This site must have been an agro-pastoral settlement.
24. Kiron Ka Khera is a Chalcolithic site situated at a distance of 10 km northeast of Gilund. It measures 21 m by 21 m. The height of the mound is 0.70 m. This is another herding unit set up for exploiting the pasture area around it.
25. Nangpura is a multicultural site, which has both Chalcolithic and Historical deposits. It is 10 km to the southeast of Gilund. The extent of the site is 100 m (E-W) by 120 m (N-S). The height of the habitation deposit is 3 m. The mound is very disturbed. The site

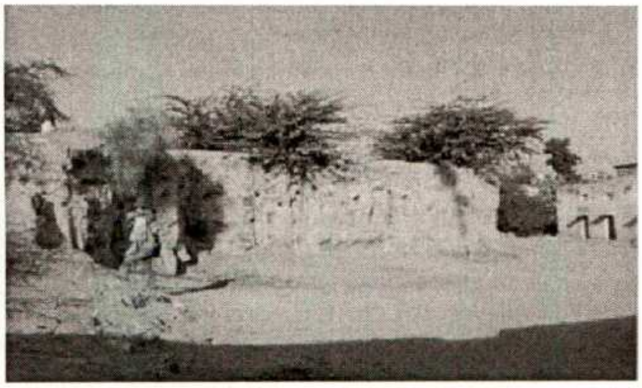


Fig. 4: Site of Pachamta

was an agro-pastoral settlement of the Chalcolithic people as is evident from the agricultural and pastoral lands around it.

26. Pachamta is a multicultural site having Chalcolithic and Historical deposit situated at a distance of 7 km west of Gilund (Fig. 4). The entire village of Pachamta is sitting on a mound. Their heights vary from 3 m to 3.5 m. This site seems to have been an agricultural and pastoral settlement of the Chalcolithic people, as there are both fertile and pastoral lands around the site.
27. Pachamta Powerhouse is a Chalcolithic site. It is located 6 km to the west of Gilund. This site is situated on a mound having a height of ½ m. The mound is 25 m (E-W), 30 m (N-S). This site was a herding unit. The area immediately around the mound is used for pasture.
28. Surawas is a multicultural site having a Chalcolithic and Historical deposit. It is located at a distance of 7 km northwest of Gilund. The intact mound measures 115 m (NE-SW). It is around 3 m in height. The surrounding area comprises fertile fields. Lands suitable for pasture are also located next to the fertile fields around ½ km north of this area. This area was an agro-pastoral settlement of the Chalcolithic people.

Pottery found at these sites consisted of Black and Red Ware, Coarse Red Ware, Fine Red Ware and Coarse Grey Ware. The shapes in Black and Red Ware and Fine Red Ware were bowls and dishes. The shapes in Coarse Red Ware and Coarse Grey Ware were globular jars.

Conclusions

Within a radius of 5 km there were seven sites, which were either farmsteads or agro-pastoral in nature, viz. Khera (1.5 km west) agro pastoral, Kumhakhera (1.5 km east) farmstead settlement, Kolpura (3 km east) farmstead settlement, Chatrikhera IV (3 km southwest), Gangas (4 km northwest) agro-pastoral settlement, Gurjaniya (4 km northeast) farmstead settlement, Karmakheri (5 km northwest) farmstead. In the radius of 5 km to 10 km there were eight sites, which were either farmsteads or agro-pastoral in nature, viz. Pachamta (7 km west) agro pastoral, Surawas (7 km northwest) farmstead, Ganeshpura (7 km southeast) farmstead, Arni (7.5 km northeast) farmstead, Bethumbi (8 km northwest) agro pastoral, Jashma (9 km southwest) agro-pastoral site, Gandrop (10 km northeast) farmstead, Nangpura (10 km southeast) agro-pastoral. The presence of a large number of sites in the catchment area, near productive lands points to the importance attached to agriculture by the Chalcolithic people of Gilund.

Pastoralism played an equally important role in the economy of Gilund. This can be gauged by the fact that there were 16 sites in the 10 km catchment of Gilund which were either pastoral or agro-pastoral in nature, viz., Dhulkhera (1.5 km north) herding site, Khera (1.5 km west) agro-pastoral site, Chatrikhera IV (3 km southwest) agro-pastoral settlement, Chatrikhera I (2.5 km southwest) herding unit, Chatrikhera V (3.5 km southwest) herding unit, Gangas (4 km northwest) agro-pastoral settlement, Pachamta Power-house (6 km west) herding unit, Pachamta (7 km west) agro-pastoral, Bethumbi (8 km northwest) agro-pastoral, Damana Dam (8 km southeast) herding unit, Gopalpura (8.5 km northeast) herding unit, Champakheri (9 km west) herding unit, and Jashma (9 km southwest) agro-pastoral site, Aloli (10 km northeast) herding unit, Kiron Ka Khera (10 km northeast) herding unit, Nangpura (10 km southeast) agro-pastoral.

Craft specialisation was in vogue in Gilund. The clay in the vicinity of Gilund was utilised in manufacturing most of the pottery seen in Gilund. Also, the excavations at Gilund yielded abundant terracotta objects, like beads, gamesman, figurines, bangles, toy pots, lamps, net sinkers, weights, votive tanks; etc. Clay for the manufacture of these materials was obtained from the catchment of Gilund which abounds in good quality clay. At present, this clay is used by the village potter.

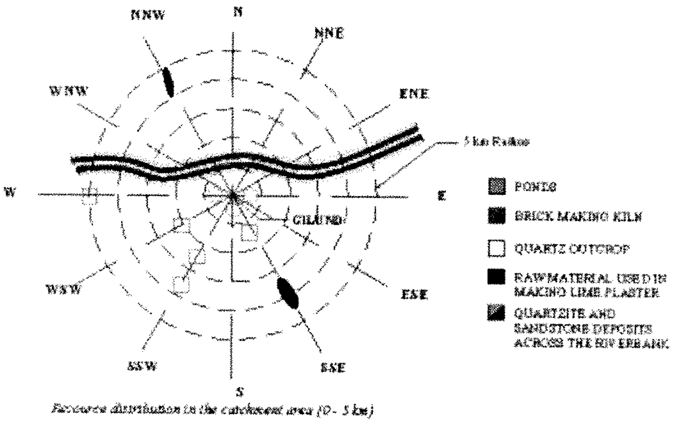
A carnelian bead workshop was also present at the site. This is evident from the presence of debitage. Raw material was obtained from north Gujarat. This was another blossoming craft.

Shell bangles were also manufactured at the site after raw material was obtained from Saurashtra. This is evident from the presence of debitage and shell bangles in good quantity. It was a major craft throughout the Chalcolithic period.

Mud-brick and sometimes burnt bricks have been used in the structures of Gilund. Evidently brick manufacturing was an important craft till the middle Chalcolithic phase. Microlithic tools and debitage have been found in good quantity at the site of Gilund from the Chalcolithic levels. Evidently these tools were manufactured at the site after obtaining raw materials from the catchment. The large quantities of tools obtained indicates that this was an important craft activity in the life of the people of Gilund all through the Chalcolithic phase. Lime plaster was used profusely in the structures of Gilund. Raw material for making lime plaster is abundant in the 10 km catchment of Gilund and was made at the site.

Hunting was not uncommon in Gilund. A few wild animal bones have been found, showing that it was indulged in occasionally. Raw material resources like brick kilns, quartz outcrops, sources for making lime plaster, and quartzite and sandstone deposits across the river banks were found in the catchment area of Gilund (Fig. 5).

Gilund was a flourishing regional centre based on surplus agricultural production and pastoralism. Craft flourished along with a thriving trade network. The perennial supply of water and the favourable ecological conditions which ensured an unhindered supply of flora and fauna, were the most important reasons for the establishment and flourishing of the site as a regional centre. Copper, semi-precious stones, conch shells, etc. which were not locally available were obtained from far off places by establishing trading contacts with cultures of adjoining regions. The Chalcolithic people of Gilund had contacts with Chalcolithic Malwa and Jorwe cultures, the South Indian Neolithic and the Harappans.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GILUND
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QUARTZ OUTCROP
RAW MATERIAL USED IN MAKING LIME PLASTER
QUARTZITE AND SANDSTONE DEPOSITS ACROSS THE RIVERBANK
Resource distribution in the catchment area (0- 5 km)

Fig. 5: Distribution of raw material resources in the 5 km catchment of Gilund

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Faunal Assemblages from Kanenur, Kaveripura and Kannikere: Iron Age/Early Historic Sites in Karnataka

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Abstract

Although a large number of Iron Age/Early Historic sites have been reported in Karnataka, there is very little information regarding the faunal material found at these sites. Recent explorations and excavations in the Mysore district (undivided) of Karnataka conducted by the third author as part of her Ph.D. dissertation, have brought to light many sites of this period. Seventeen new sites were located by her, of which three sites namely Kanenur, Kaveripura and Kannikere have yielded faunal remains. This paper presents the results of faunal studies conducted at these sites. The results indicate a heavy dependence on animals for food and other activities.

Introduction

The district of Mysore (undivided) is situated in the southernmost part of Karnataka, and is characterised by an undulating gneissic plain ranging from 600 to 800 m ASL. The district is bounded in the southeast by the charnockite hill ranges of the Eastern Ghats, namely the Biligiriranga and Mahadeshwara groups, which attain an altitude of around 1800 m. Offshoots of the Western Ghats form the southwestern boundary of the district and are marked by the Bandipura and Nagarahole sanctuaries located along the foothills. Dry and moist deciduous forests cover these hill ranges. The Kaveri flows largely along the district boundaries separating this region from the Mandya and Bangalore districts to the north and Tamil Nadu to the east. The district is drained by the right bank tributaries of the Kaveri, namely the Suvarnavathi, Kabini and Lakshmanatirtha.

Despite its archaeological wealth dating back to prehistoric cultures (Shivarudrappa 1990), this district has not received much attention. Consequently, very few sites of this period were documented. Exceptions are sites of the Neolithic phase, which drew the attention of researchers to T. Narasipur (Seshadri 1971) and Hemmige (Hanumantha Rao and Nagaraju 1974) during the late 1950s and the early 1960s, when issues related to the Neolithic formed one of the major concerns of archaeology. At the site of T. Narsipur, a three-fold sequence was identified; *viz.* Neolithic, Megalithic and Early Historic, and was thought to have revealed for the first time the 'culture sequence of the Upper Kaveri Valley' (Seshadri 1971: 3). Small sites such as Buditittu (IAR 1968-69: 24) and Muttalavadi (IAR 1974-75: 20; Krishna Murthy 1971) were also excavated in order to verify the culture sequence of the region. During the same period, village to village surveys of the Archaeological Survey of India brought to light innumerable Megalithic burial sites in addition to nearly forty habitation sites with a Megalithic-Early Historic sequence in this region (Seshadri 1961: 3-14; Krishna Murthy 1978: 80-89: IAR 1960-61: 28; 1961-62: 34-35; 1962-63: 17; 1967-68: 37-39; 1971-72: 27; 1980-81: 93; 1981-82: 93-94; 1989-90: 38-39; 1992-93: 45). Both epigraphical and architectural studies related to the subsequent Ganga and other medieval kingdoms dominated the research scenario in the 1980s. As a result there was a lull in archaeological investigations until excavations at Talakadu, the second capital of the Western Gangas, were initiated in 1992-93 (Devaraj *et al.* 1996). The main focus here was on the archaeology of the Early Historic and Ganga periods about which little was known.

The Early Historic phase is represented in the upper levels at both T. Narasipur and Hemmige while at Talakadu, it occurs between deposits ascribable to the late Megalithic phase and the Ganga period. This phase has been assigned a date between the 1st and the 3rd century A.D. on the basis of the russet coated painted ware, the diagnostic pottery of this culture, the imitated rouletted ware at T. Narasipur and the terracotta Roman coin mould at Talakadu. However, the cultural assemblage from these sites is sparse and hence limits our perception of the Early Historic phase in this region in particular, and in the upper Kaveri basin in general. All that we presently know about this culture is that it is represented by russet coated painted ware, and that the sites have no Satavahana influence.

Keeping this in mind, archaeological surveys including re-documentation of the reported sites, random surveys as well as trial excavations were undertaken between 2001 and 2004, in parts of the district in pursuit of a coherent understanding of this culture (Shobha 2006). Seventeen new Early Historic locations were identified during these surveys and trial excavations were conducted at five sites. The trenches at Kanenur, Kaveripura and Kannikere (Fig. 1) yielded a significant quantity of animal remains, which were studied by the first two authors. It may be noted in this context, that such studies, although on a preliminary level, have been conducted at only two Early Historic sites in Karnataka *viz.* Piklihal (Allchin 1960) and Maski (Thapar 1957). This paper provides a report of the faunal analysis carried out on animal remains comprising bones, shells, shell bangles and bone tools from the three sites mentioned above.

Kanenur (12° 5' 49" N & 76° 31' 7" E)

Kanenur is situated on the right bank of Kabini, a tributary of the river Kaveri, Mysore district, Karnataka. A trial trench measuring 1.5 m^2 was excavated in the elevated central part of the mound. It was dug to a depth of 111 cm. Antiquities recovered included shell bangle fragments, iron objects, bone objects, a terracotta bead and animal bones.

A total of 314 bones were studied, out of which 75% were identifiable to the species level. 23 bones were charred. A total of 17 animal species have been identified, comprising mammals, birds, reptiles and molluscs (Table1).

Table 1: Animals identified at Kanenur

Species	NISP
Cow/ox (*Bos indicus*)	11
Buffalo (*Bubalus bubalis*)	7
Cow/Ox/Buffalo) *Bos/Bubalus*	77
Donkey (*Equus asinus*)	1
Goat (*Capra hircus*)	16
Domestic cat (*Felis domesticus*)	1
Domestic fowl (*Gallus domesticus*)	9
Gaur/Wild buffalo (*Bos gaurus/Bubalus arnee*)	7
Gaur (*Bos gaurus*)	3
Chital (*Axis axis*)	7
Blackbuck (*Antilope cervicapra*)	16
Nilgai (*Boselaphus tragocamelus*)	2
Hare (*Lepus nigricollis*)	2
Wild pig (*Sus scrofa*)	2
Common house rat (*Rattus rattus*)	3
Smaller ruminant	63
Monitor Lizard (*Varanus bengalensis*)	2
Mussels (*Lamellidens* sp.)	1
Mussels (*Parreysia* sp.)	8
Unidentified fragments	76
Total	314

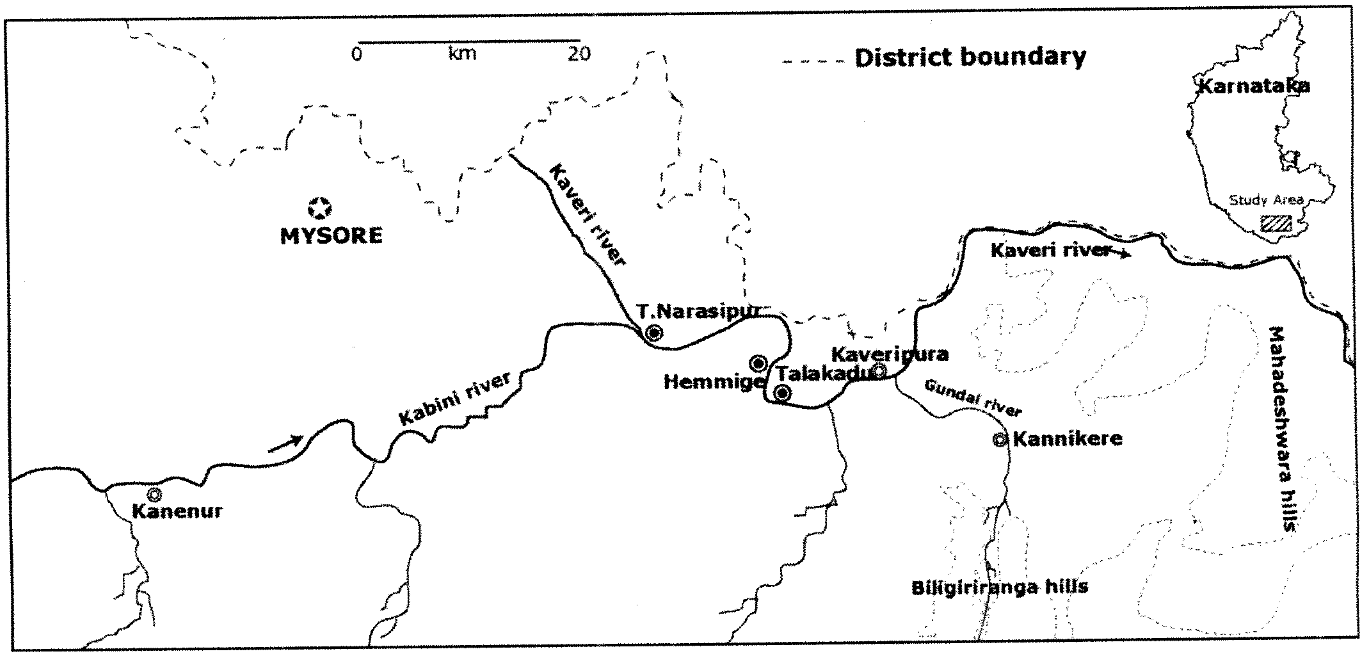

Fig. 1: Map of District Mysore showing important sites

Mammals

A total of 13 species are represented which include both wild and domestic animals. A majority of the animals are wild herbivores. Cattle (*Bos indicus*) are predominant. Almost all body parts of cow/ox are represented in the collection. The presence of humped cattle (Zebu) is evident from the bifid spine of the thoracic vertebra identified (Fig. 2). Buffalo (*Bubalus bubalis*): A few bones and dentition were identified. They probably played an important role in the economy of the inhabitants of Kanenur. Fragmentary bones make it often difficult to differentiate between the bones of cattle and buffalo. Therefore, the general group (*Bos/Bubalus*) refers to bones which may belong to either species. This group is represented by a large number of bones from almost all depths of the excavations. Therefore, it is suggested that both animals (cattle and buffalo) may have equally contributed to the economy. Domestic goat (*Capra hircus*) is represented by the pelvis, scapula, phalanges, metapodials, vertebrae and teeth. Interestingly these are also found from all levels, suggesting a small herd occurring throughout the occupation of the site. Fragments of vertebrae, ribs and long bones could not be identified with certainty, therefore such bones have been placed under the group of smaller ruminants.

Donkey (*Equus asinus*): A complete patella (knee cap) was found from the middle level of the excavation, and implies possible use as a beast of burden. No human activity was noted on this bone found at Kanenur. Domestic cat (*Felis catus*): One canine tooth was found in the upper levels.

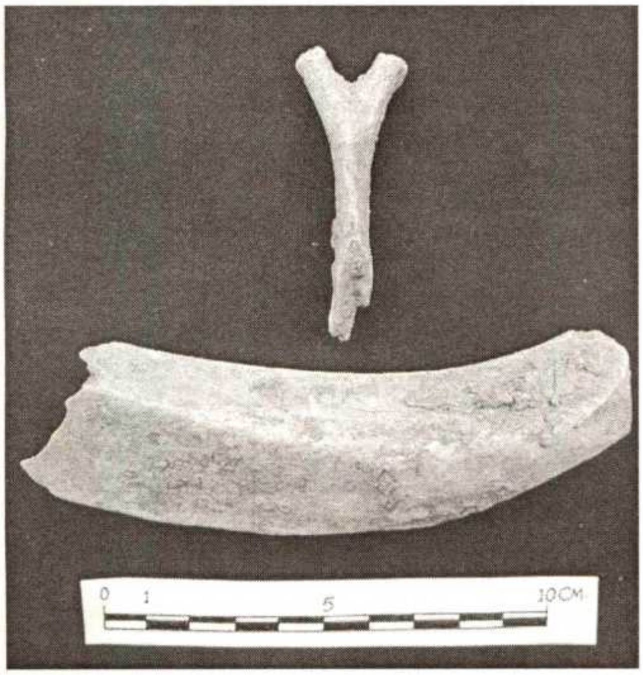

Fig. 2: Kanenur: *Bos indicus* (Top) Bifid spine of thoracic vertebra, (Bottom) rib with cut marks.

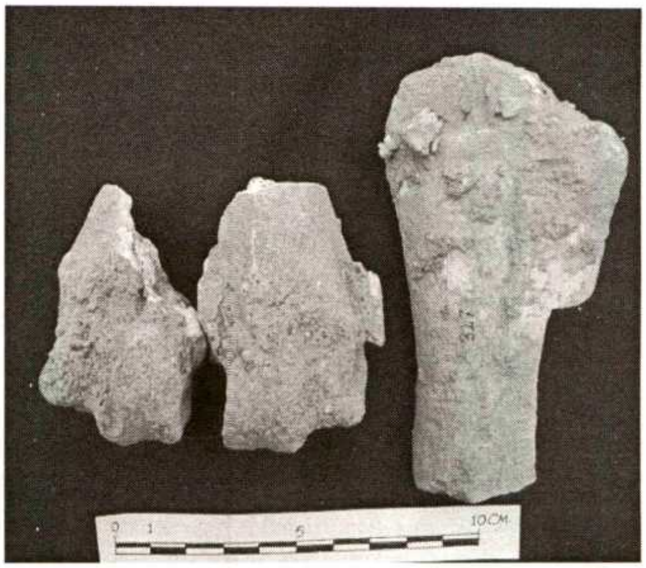

Fig. 3: Kanenur: *Bos gaurus* metapodials

Gaur (*Bos gaurus*): A metatarsal could be identified with certainty (Fig. 3) and occurs at a lower level (88-95 cm). Gaur/Wild buffalo (*Bos gaurus/Bubalus arnee*): A few bones representing the scapula, pelvis and vertebra in the collection show slight morphological variations from that generally seen in domestic cattle and buffalo, and are quite large in size. These are identified as those of the gaur or wild buffalo.

Blackbuck (*Antilope cervicapra*): is represented by 16 bones including tibia, radius, ulna, femur, astragalus, calcaneum, teeth, etc (Fig. 4). They occur at almost all levels. Nilgai (*Boselaphus tragocamelus*) is represented by a complete astragalus (Fig. 4) and a broken metatarsal.

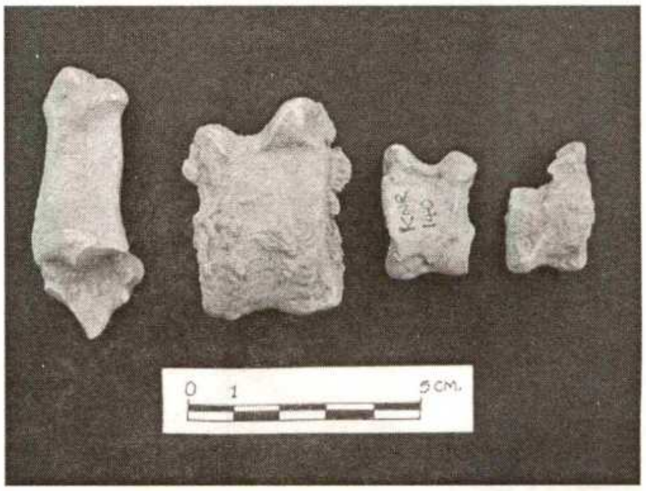

Fig. 4: Kanenur: From left: 1st *Antilope cervicapra* calcaneum; 2nd *Boselaphus tragocamelus* astragalus; 3rd *Axis axis* Astragalus; 4th *Antilope cervicapra* astragalus.

Spotted deer or chital (*Axis axis*): is identified by the presence of radius, femur, tibia, astragalus (Fig. 4) and maxillary teeth, which occur both in the upper and lower levels.

Wild pig (*Sus scrofa cristatus*): is represented by a portion of a radius and a pelvis.

Hare (*Lepus nigricollis*): Two proximal portions from the femur are present.

Common house rat (*Rattus rattus*): Fragments of femur and one tibia are present. No human activity is noticed on these bones. The rat possibly represents a later intrusion into the archaeological deposit.

Non-mammals

Domestic fowl (*Gallus domesticus*) is represented by a few long bones.

Monitor lizard (*Varanus bengalensis*): Two broken mandibles were identified.

Molluscs comprise complete and fragmented shells of only freshwater bivalves. Identification was possible only to the generic level because of the fragmentation of the shells. Two genera identified are *Lamellidens* and *Parreysia* (Fig. 5).

Discussion

At Kanenur a wide range of animals are represented, and preservation of bones is also fairly good. Cattle and buffalo bones predominate. The presence of both wild and domestic fauna was possibly a result of both hunting and animal husbandry. Hunting of gaur, wild buffalo, chital, nilgai, blackbuck and wild pig is indicated. Some bones display cut marks and charring which suggest that many animals were exploited for food. Domestic animals such as the cow, buffalo, goat, and donkey may have been used for various other activities. The abundance of cattle at the site may have been a result of the realisation of their multiple uses. Cattle had indeed played a very significant role in the subsistence economy of most prehistoric and protohistoric settlements. Secondary products such as milk, cow dung, hide, etc. were of economic importance as well. The presence of freshwater bivalve molluscs, *Parreysia* sp. and *Lamellidens* sp. are also observed. These might have been eaten or were accidentally introduced. A few plain narrow bangle fragments of chank shell (*Turbinella pyrum*) were also recovered from the site. The varied faunal assemblage not only throws light on the activities that occurred at the site but also on the local environment. The presence of gaur, wild buffalo, deer and wild pig indicates a forested landscape with adequate grass cover and a wet climate.

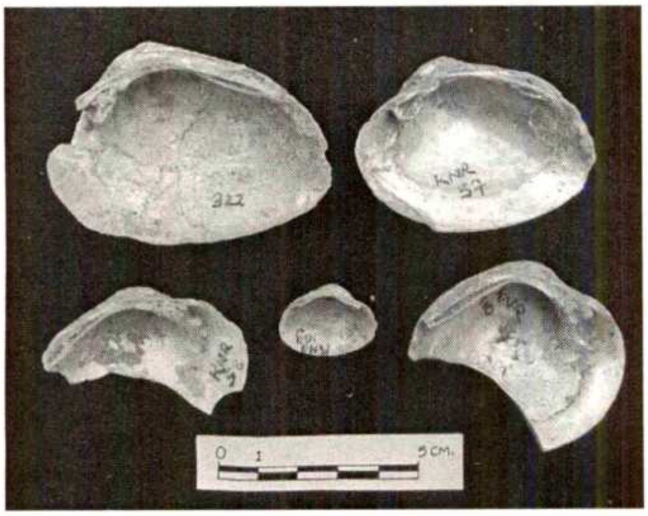

Fig. 5: Kanenur: *Parreysia* sp. Bivalves

Kaveripura (12° 11' 21" N 77° 6' 23" E)

Kaveripura is located on the left bank of the river Kaveri in the T. Narasipura taluka, Mysore district. A step trench of 1x1 m was taken to a depth of 150 cm. The excavation revealed faunal remains, iron objects, shell bangles, pottery, worked bone pieces, etc.

A total of 108 bones were studied from a depth of 48 cm to 150 cm. Five species of mammals and one molluscan species were identified (Table 2). Bone preservation is relatively good, barring the fact that most bones are fragmented with very few being measurable (n = 3). As compared to long bones, there is a greater representation of teeth and ribs. Among the mammals both domestic and wild species occur. Domestic species include *Bos indicus* (cow/ox), *Bos/Bubalus* (cow/ox/buffalo) and *Capra hircus* (goat). Among these, bones of smaller ruminants predominate. Ribs and vertebral fragments of a species smaller than goats, which however, could not be identified with certainty, are placed under this group. Wild species include the spotted deer or chital (*Axis axis*) and nilgai (*Boselaphus tragocamelus*), which are however represented by a small sample. A freshwater bivalve, *Parreysia* sp. is noted. Charring is observed on very few bones and evidence of cut marks is quite negligible. Shell bangle fragments made of chank shell are also noticed in the collection. Bone tools, especially points and awls made from the thick cortex of long bones of larger animals were recovered from the site (Fig. 6).

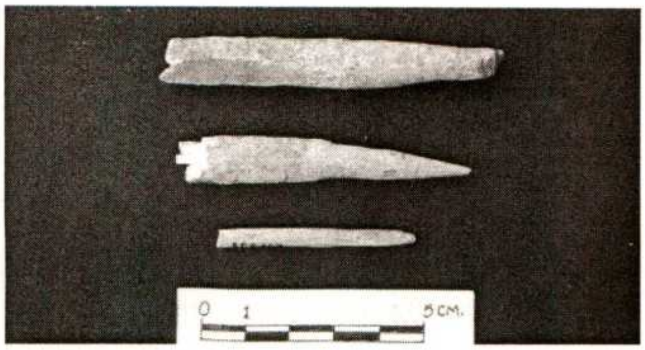

Fig. 6: Kaveripura: Bone tools

Table 2: Animals identified at Kaveripura

Species	NISP
Cow/Ox (*Bos indicus*)	1
Cow/Ox/Buffalo (B*os/Bubalus*)	17
Goat (*Capra hircus*)	4
Chital (*Axis axis*)	2
Nilgai (*Boselaphus tragocamelus*)	1
Smaller ruminant	20
Molluscs:*Parreysia sp.*	1
Unidentified fragments	62
Total	108

Kannikere (12° 8' 37" N; 77° 12' 5" E)

The habitation site of Kannikere is situated in Kollegala taluka of Chamarajanagara district. A trench of 1.5x1.5 m was laid in the field 25 m north of the left bank of river Gundal. Antiquities recovered were pottery, copper bead, shell bangle pieces and animal bones.

A total of 56 bones were studied from 14 digs ranging from 0-4 cm to 125-141 cm. Bone preservation is fairly good. Measurable bones are very few as also identifiable parts. Seven species have been identified including mammals (5), bird (1) and molluscs (1) (Table 3). Amongst mammals, domestic species are represented by cow/ox (*Bos indicus*), cow/buffalo (*Bos/bubalus*) and small ruminants (perhaps a few bones of goat). Wild species include wild pig (*Sus scrofa*) (Fig. 7) and hare (*Lepus nigricollis*). Among the birds, the domestic fowl (*Gallus domesticus*) has been identified. A single broken shell of the freshwater bivalve, *Parreysia sp.* is present. Very few bones show charring. Certain bone fragments probably represent bone tools as they show evidence of working. These are largely modified long bone fragments. A few fragments of chank (*Turbinella pyrum*) shell bangles are also noticed in the collection. These are narrow, plain and without any decoration.

Table 3: Animals identified at Kannikere

Species	NISP
Cow/Ox (*Bos indicus*)	2
Cow/Ox/Buffalo (*Bos/Bubalus*)	9
Domestic fowl (*Gallus domesticus*)	1
Hare (*Lepus nigricollis*)	1
Wild pig (*Sus scrofa cristatus*)	1
Smaller ruminants	7
Parreysia sp.	1
Unidentified fragments	22
Total	56

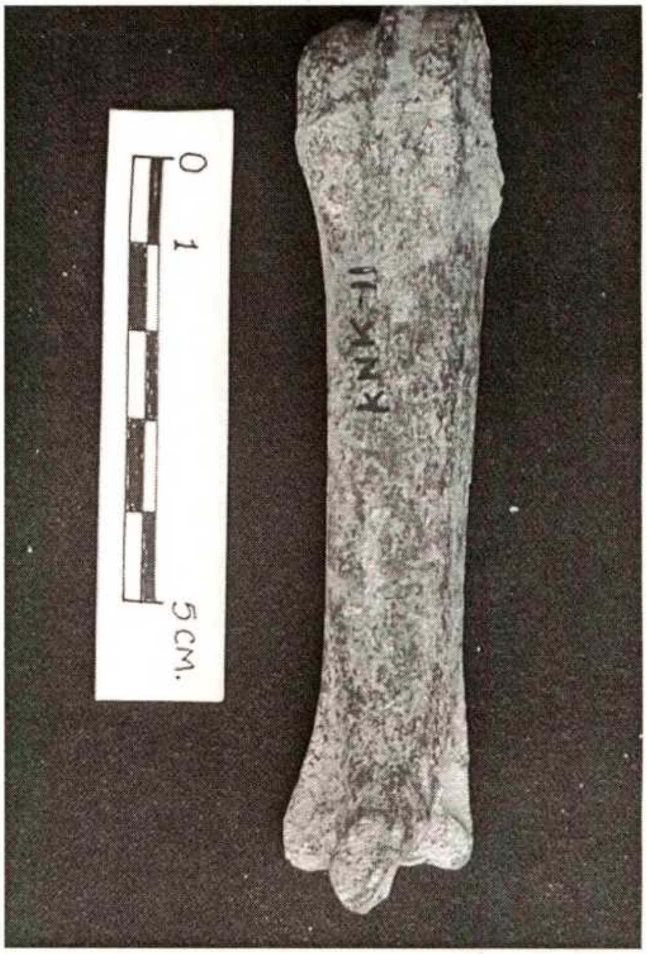

Fig. 7: Kannikere: *Sus scrofa* Metapodial

Acknowledgements

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Scientific Rationale of the Underground Storage System in Ancient India (up to *c.* 550 A.D.)

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Abstract

The underground storage system was practised from ancient times and is still prevalent in some parts of India. A brief description of different types of underground storage systems practised in north India and the Deccan till *c.* 550 A.D. is given here. An attempt has been made to investigate the scientific rationale behind this type of storage system. It is argued that this type of storage technology is environmentally benign.

Introduction

Agriculture depends on a number of factors like soil types, temperature variations, rainfall, tools, and technologies implemented. The available sources of information suggest that floods and droughts were not unknown in ancient India. This naturally brings into focus the system of storage of crops. Underground storage was one of the various methods by which crops were stored in ancient India. This type of storage system is represented by storage pits and cellars. Sometimes storage jars were found embedded on the floor of dwelling structures of ancient settlements. The prevalence of underground storage was observed in specific regions. Most storage pits found at ancient sites were lined with either lime or clay. The purpose of this paper is to investigate the scientific rationale behind the practice of underground storage systems in ancient India.

Practice of Underground Storage in Ancient India

One of the earliest evidences of underground storage was found at the Neolithic sites of Burzahom and Gufkral in Kashmir (Thapar 1985: 25-29). These pit dwellers used shallow pits for storage. The floors of the storage pits were treated with red ochre. Storage pits were also found in Neolithic sites of the Swat valley region belonging to *c.* 1700-1400 B.C. (Stacul 1996: 435). The culture in the Swat valley regions shared certain similarities with the northern Neolithic cultures of Kashmir. Conningham and Sutherland (1997: 29-34) have identified dwelling pits of Kashmir as being granaries. They also have tried to draw analogies with the pits of the British Iron Age. At the same time they mention that there are a number of methodological and theoretical problems which must be addressed to test this new hypothesis. Fresh problem oriented excavations are also required. At present, with the available data it is difficult to come to any definite conclusion as to whether these dwelling pits were really used as granaries.

A cultural change was observed in the northwestern part of the subcontinent around the fourth and third millennium B.C. This change has been identified as the precursor of the mature Harappan period. During this period the practice of pit storage was observed at Banawali and Kalibangan in Rajasthan (Bisht 1982: 113-124; Thapar 1985: 53-64; Thapar and Mughal 1992: 253; Lal 1979: 65-97). Most of these pits were plastered. Both these sites lie in the Ghaggar-Hakra drainage system.

The practice of pit storage was also observed in the subsequent Mature Harappan period. Storage pits were found at Mitathal in Haryana and Kuntasi in Gujarat (Bhan 1975; Dhavalikar and Atre 1996: 43-91). Storage jars embedded in floors were found in one of the rooms at Kalibangan belonging to this period (Lal 1979: 65-97). As in the previous period, a geographical similarity has been observed between these sites.

A large number of pit storage sites, mostly located in western India, were found in the period following the decline of Harappan urbanism and the subsequent growth of the second urbanism in the middle Ganga plains. The practice of underground storage was observed at Gilund, Ahar and Balathal, all located in Rajasthan. Storage pits were found at the Chalcolithic site of Gilund and Balathal (Ghosh 1989: 150-151; IAR 1995-96: 64-70; IAR 1996-97: 90-100; Misra *et al.* 1997: 35-59). The storage pits of Gilund were lined with white clay mixed with sand (Ghosh 1989: 150-151). However, no grains were found inside them. Storage jars were found half-embedded in the floors of rooms at Ahar (Sankalia *et al.* 1969: 8,12; Ghosh 1989: 5-6). An interesting feature of Ahar, is that the floor of the residential area differs from that of the storage area. A gravel based floor was found in the residential area while gravel and clay were removed from the storage area (Sankalia *et al.* 1969: 12). This indicates that crop storage played an important role in the domestic life of Ahar. Storage jars embedded within floors were found at Rangpur in Gujarat, belonging to this period (Rao 1963: 5-207). The practice of underground storage was observed in a number of Chalcolithic sites in Maharashtra, such as that of Navdatoli, Kaothe, Nevasa, Daimabad, Inamgaon, Walki and Songaon (Sankalia *et al.* 1971; Dhavalikar *et al.* 1990; Sankalia *et al.* 1960; Sali 1986; Dhavalikar *et al.* 1988; Dhavalikar 1997; Deo *et al.* 1969). Storage jars embedded within the floor have been found at Navdatoli and Nevasa in Maharashtra (Sankalia *et al.* 1958: 24; Sankalia *et al.* 1960: 42). A granary has been found at Inamgaon, where both underground and above ground storage was practised (Dhavalikar *et al.* 1988: 189-193). It is interesting to note that all these sites are located in black soil. Evidence of underground storage was also found outside the black soil region. Storage jars embedded within floors were found at the OCP sites of Lal Qila in the Bulandshahr district of Uttar Pradesh (Gaur 1995: 17). Underground storage was also practised at the Chalcolithic site of Mahisdal in Birbhum district of West Bengal belonging to this period (Ghosh 1989: 267; Ghosh 1984: 17; Dhavalikar 1997: 244).

However, archaeological evidence of the practice of underground storage is sparse during subsequent periods (*c.* 600-200 B.C.) Silos were found in a wattle and daub house at Balathal in Rajasthan, belonging to the early Historic period (340 B.C.-130 A.D.). Literary evidence supports the practice of underground storage in the Mauryan period. In Kautiliya's *Arthasastra* it is mentioned that salt was stored underground (Kangle 1972: 127).

Interestingly, considerable archaeological and literary evidence of granaries are noted during the period after the fall of the Mauryan Empire. A barn made of bricks belonging to the Satavahana period was found at Nevasa. A cellar was found inside a room at Sringaverpura in Allahabad district of Uttar Pradesh belonging to the Kushana period (IAR 1984-85: 85-86). An underground storage structure of the 3rd and 4th century A.D. was found in Khairadih in Ballia district of Uttar Pradesh (IAR 1982-83: 92-93). Underground storage is also mentioned in the *Jataka* tales. In the *Ucchittha-Bhatta Jataka*, the wife of a *brahmaṇa* hid a man in an underground store (*kotthe*) (Fausboll 1963: 167-169; Cowell 1990: 117-118). The underground store mentioned in this text was large enough for a man to hide. A change can be noticed in the practice of underground storage during this period. Cellars or underground stores larger than storage pits of the previous period were now used. This indicates that a large quantity of crops were stored in underground structures. Thus, there was greater agrarian surplus during this period. It is also interesting to note, that some of the underground storage sites are located in the middle Ganga plains. Storing large quantities of grain in underground structures indicates the anxiety of the people.

The practice of underground storage was also observed during the existence of a pan-Indian Empire like the Gupta Empire (320-550/570 A.D.). An underground granary of the 4th-7th c.A.D. was exposed during the Rajghat excavation at Varanasi (Singh 1985: 58-70). Thirteen underground structures were found here. These structures were rectangular and square in shape. They were broader at the top and narrower at the bottom (hopper shaped). Many of them were provided with holes at regular intervals along the side-walls. This was perhaps for placing wooden beams to enable easy access to the base. At the same time it should be noted that they were shallow. It was suggested by Singh (1985: 58-70) that these holes were used for placing planks for dividing the underground structure into several compartments for different types of grain, or for storing grain belonging to different owners. These structures are located near the river Ganga. Singh (1985: 58-70) infers that they were used for storing grain by grain merchants of Varanasi. Sharma (1987: 36) suggests that these structures were an indication of insecurity.

Underground Storage System in Modern India

Underground storage is practised even today in some parts of India, such as in Madhya Pradesh, Uttar Pradesh and Maharashtra. In Madhya Pradesh circular underground pits (*bunda*) are constructed in the open, usually on elevated grounds. They are 1.37 to 1.98 m deep with a diameter varying from 3.65 to 4.57 m. The inner wall is either plastered with mud or made of bricks plastered with mud. In some cases, the floor is plastered with cement or a thick layer of mud. When dry, they are plastered with cow dung. In Uttar Pradesh, pit storage is practised in Jaunpur and Lalitpur districts. In both these regions, storage pits with diameters of 1.5 to 2 m and depths of 6 to 10 m are used. The inner sides are plastered with cow dung. Before storing grain, a thick cushion of straw is placed at the sides and on the bottom of the pit. The pits at Lalitpur are sealed at the top, first by placing wooden planks, and then by a layer of earth mixed with straw (Singh 1985: 67-68). At Inamgaon this type of storage system is still prevalent. At present, pit silos are used for storing jowar instead of barley, whereas wheat is stored above ground as was done during the Jorwe period (Dhavalikar *et al.* 1988: 189-193).

Purpose of Underground Storage

Underground storage, in a way, points to anxiety. The very presence of a cellar or an underground store indicates that grains were hidden to prevent them from being seized or for dealing with emergencies. An important factor is the geographical location of such storage systems. It has been observed that pit storage was practised in specific regions. Most pits were plastered with lime or clay, and pits were roughly of the same depth. This implies a scientific rationale behind the practice of this type of storage system.

Scientific Rationale of Underground Storage Systems

Grain storage involves many problems due to the fact that grain is a living substance and can thus perish. Humidity (moisture content) and temperature are the most important elements in this context (Boumans 1985: 15). Excessive humidity or heat can lead to sultriness and mould if the grain is stored too long. The proper storage of grain requires a moderate temperature (about 20 °C) that should not fluctuate widely and also low humidity (below 50%) within the storing environment (Desrosiev and Desrosiev 1998). Damage of food grains during storage, occurs due to bacterial, fungal or mould contamination. These are living organisms and require a carbon source to proliferate and to maintain metabolic activities. Micro-organisms fulfil these requirements from the substrata (e.g. food grains) on which they grow. Certain environmental parameters are also required for the growth of micro-organisms, and are organism specific. These include temperature, pH, moisture content, presence of oxygen, incubation time and supply of micro-nutrients. If any one of these conditions becomes unfavourable i.e., goes beyond the stipulated range, microbial action is retarded or even completely stopped. In other words, it is possible to prevent food material from decaying as a result of microbial contamination by simply manipulating the environmental parameters required for the growth of micro-organisms. The acidity or alkalinity (pH[1]) is the single most important parameter affecting the growth of micro-organisms. All micro-organisms are pH sensitive and grow normally in the acidic to near neutral region. Bacteria grow in the pH range of 6.5 to 7.2 and fungus in the pH range of 4.5 to 6.5. If the medium is alkaline i.e., pH is greater than 7, activities of micro-organisms are retarded. Their growth is impeded and almost stopped if the alkalinity of the medium is further increased. It has been found that micro-organisms' populations are highest in neutral or near neutral soil (Biswas and Mukherjee 1987: 41). Most micro-organisms are unable to tolerate highly acidic or highly alkaline soils.

It has been observed that most sites where underground crop storage was practised in ancient India, are located in soils with high alkalinity (Table 2). The majority of sites such as Navdatoli, Kaothe, Nevasa, Daimabad, Inamgaon, Walki and Songaon are situated in medium or deep black soil. These soils are highly alkaline. Pit storage was also found in alkaline soils like desert soil (Kalibangan), red and black soil (Gilund), pedocal sierozem of alluvial origin (Banawali, Mitathal), alluvial soil riverine non-saline non-calcareous to moderately calcareous (Rangpur), alluvial riverine soil highly calcareous (Ahar, Sringaverpura, Varanasi) and alluvial riverine soil affected by salinity and alkalinity (Lal Qila). In black soils, alkalinity further increases with depth. So in some of the more shallow storage pits, lime plaster was found on the inner walls. Lime increases alkalinity. Storage pits found in acidic soils like Balathal were plastered with lime perhaps in order to raise the pH of the inner walls to an alkaline level. Some storage pits were plastered with cow dung, mud or mud mixed with lime, perhaps to reduce moisture migration from the soil to the stored grain. Although archaeological evidence does not support the existence of any sort of roofing to cover the storage pits, it can be assumed from analogies drawn from modern practises, that this was present. Further, they were probably covered on top and sealed with sealants like mud or straw mixed with mud to make them airtight.

Another interesting feature in the storage of food grains is the presence of oxygen in the storing environment. Stored grain breathes and requires a certain volume of oxygen, which is converted to an almost equal proportion of carbon dioxide (CO_2). Due to constant respiration of the stored grains, the oxygen concentration of the closed pit decreases and carbon dioxide increases (Boumans 1985: 16). The increasing concentration of CO_2 then causes respiration to slow down further and as a result the growth of micro-organisms (mould and bacteria) practically comes to a standstill. Thus, underground storage prevents contamination by pests by creating a reducing atmosphere. It has been observed recently that this type of storage system is an environment friendly process since it reduces the use of pesticides.

In any region, the sub-soil temperature differs from the surface soil temperature or the above ground ambient temperature. The average monthly subsoil temperatures for depths ranging from 0.3 m to 3.6 m indicates that during the early part of a year i.e., in winter, the surface soil has the lowest temperature, but the subsoil is progressively warmer with increasing depth. Although the surface soil becomes progressively warmer in February, March and April, the lower subsoil becomes progressively colder, attaining in April its lowest average monthly temperature for the year (Smith 1932: 421-428). It is perhaps due to this reason, that pit storage was practised in Burzahom,

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[1] pH is a scale by which acidity or alkalinity of a medium is expressed It ranges from 0 to 14 Number 7 in the pH scale is taken as neutral. If pH of a medium goes below 7 acidity increases and above 7 alkalinity increases

Table 1: Archaeological evidence of underground storage

Culture	Site, Location, District and State	Findings	Period	References
Neolithic	Burzahom 34° 10'N; 73° 54'E Srinagar, J & K	Storage pits, diameter 0.60-0.91 m	2800-2000 B.C.	Kaw 1979, Thapar 1985
Early Harappan	Banawali 29° 35' 5"N; 74° 05'E Hissar, Haryana	Circular pits, thickly plastered walls, charred grains found	*c.* 2500-2300 B.C	Bisht 1982, Thapar 1985, Thapar and Mughal 1992
Early Harappan	Kalibangan 29° 05'N; 74° 05'E Ganganagar, Rajasthan	Cylindrical pits, lined with lime and plaster	*c.* 3000-2500 B.C.	Lal 1979, Thapar 1985
Mature Harappan	Kalibangan 29° 05'N; 74° 05'E Ganganagar, Rajasthan	Storage jars embedded in floor	*c.* 2500-2000 B.C.	Lal 1979
Mature Harappan	Mitathal 28° 50'N; 76° 10'E Biwani, Haryana	Circular and cylindrical pits lined with chaff mixed with clay, diameter 1-1.30 m and 1-2m deep	1700-1500 B.C.	Suraj Bhan 1973, Ghosh 1989, Dhavalikar 1997
Mature Harappan	Kuntasi 22° 45'N; 70° 36'E Gujarat	Pit silo (1.20 x 0.85 m), Small rectangular pit (1.50 x 0.60 m), Storage pit (4.80 x 1.40 x 0.170 m)	*c.* 2200-1900 B.C.	Dhavalikar and Atre 1996
Late Harappan	Banawali 29° 35'5"N; 74° 05'E Hissar, Haryana	Large underground silos and small pit perfectly circular with vertical sides	*c.* 1700-1400 B.C.	Bisht 1984
Late Harappan	Daimabad 19° 31'N; 74° 42'E Ahmadnagar, Maharashtra	Several Pit silos were found. Lower portion of a storage jar embedded on the floor has been found	*c.* 2000-1800 B.C.	Sali 1986
Chalcolithic	Ahar 27° 42'N; 75° 55'E Udaipur, Rajasthan	Storage jars half sunk into the floor of the room	1940±95, 1725±110, 1270±10 B.C.	Sankalia *et al.* 1969, Ghosh 1989
Chalcolithic	Balathal 24° 43' N; 73° 59' E Udaipur, Rajasthan	Phase II: Circula silos, diameter 1.40-1.60 m and 0.52 m deep, oblong silos, diameter 1.70 and 0.55 m deep, plastered with clay and cow dung Phase III: Circular silos, diameter 1.60 and 0.15 m deep, plastered with mud and cow dung	2800-1500 B.C.	IAR 1995-96, IAR 1996-97, Misra *et al.* 1997
Chalcolithic	Rangpur 22° 26' N; 71° 55' E Surendranagar, Gujarat	Storage jar embedded on the ground	*c.* 1700-1400 B.C. (Rangpur culture)	Rao 1963, Ghosh 1989, Dhavalikar 1997

Culture	Site, Location, District and State	Findings	Period	References
Chalcolithic	Navadatoli 22° 11' N; 75° 36' E Nimar, M.P.	Storage jar fixed in the ground	*c.* 1500-1000 B.C. (Chalcolithic period)	Sankalia *et al.* 1958, Sankalia *et al.* 1971
Chalcolithic	Kaothe 21° 00' N; 74° 18' E Dhule, Maharashtra	Pit storage (Chalcolithic period)	2000-1800 B.C.	Dhavalikar *et al.* 1990
Chalcolithic	Nevasa 19° 34' N;74° 54' E Ahmadnagar, Maharashtra	Chalcolithic period: Storage jars embedded on floor, oval pits (length 1.2-2.7 m width 0.9-1.5 m and depth 0.5-1.2 m), not all had plastered sides	*c.* 1500-1000 B.C.	Sankalia *et al.* 1960
Chalcolithic	Daimabad 19° 31'N; 74° 42' E Ahmadnagar, Maharashtra	Large circular pits	*c.* 1600-1400 B.C.	Sali 1986
Chalcolithic	Inamgaon 18° 36' N; 74° 32' E Pune, Maharashtra	i. Malwa period: Pit silos ii. Jorwe period: Pit silos (layer of sand and pebbles rammed at the bottom) 1.85 m diameter and 0.20 m deep, granary with pit silos iii. Late Jorwe Period: Pit silos (1.85 m diameter and 0.20 m deep)	i. 1600-1400 B.C. (Malwa period) ii. 1400-1000 B.C. (Jorwe period) iii. 1000-700 B.C. (Late Jorwe Period)	Dhavalikar *et al* 1988
Chalcolithic	Walki 18° 35' N; 74° 18' E Pune, Maharashtra	Pit silos	*c.* 1500-1200 B.C. (Chalcolithic period)	Dhavalikar 1997
Chalcolithic	Songaon 18° 00' N; 74° 35' E Pune, Maharashtra	Pit silos, diameter 1 m and 1 m deep	1465 B.C. (Chalcolithic period)	Deo and Mujumdar 1969
Chalcolithic	Lal Qila 28° 10' N; 78° 12'E Bulandshar, Uttar Pradesh	Storage jar embedded on floor	2030 and 1730 B.C	Gaur 1995
Chalcolithic	Mahisdal 23° 42' N; 87° 42 'E Birbhum, West Bengal	Pit granary, roughly circular, diameter 1.28 m and 1.25 m deep, carbonised grains recovered	1380±105, 1085±110 B.C.	Ghosh 1989, Ghosh 1984, Dhavalikar 1997
Early Historic	Nevasa 19° 34' N;74° 54' E Ahmadnagar, Maharashtra	A barn built of bricks laid in a 3.6 m deep pit, charred grains found	28 B.C.-225 A.D.	IAR 1955-56

Culture	Site, Location, District and State	Findings	Period	References
Early Historic	Sringaverpura 25° 35' N; 81° 95' E Allahabad, Uttar Pradesh	Storage jar embedded on floor, A cellar about 2.60 m deep with 38 courses of burnt bricks was found. Copper bowl, remains of seeds and other pulses were found inside it	Late Kushana period	IAR 1984-85
Early Historic	Khairadih, Ballia, Uttar Pradesh	Underground structure for storage measuring 1.07 x 0 94 m	3rd-4th C A.D.	IAR 1982-83
Early Historic	Varanasi 25° 4' 39" N; 83° 1' 30" E Uttar Pradesh	Underground granary	4th-7th C A.D. (Gupta period)	Singh 1985

Kashmir which is completely covered with ice in winter. In such a situation, the subsoil temperature is much warmer and thus suitable for storing grains.

The flow of heat from the upper soil to the lower subsoil depends on the thermal conductivity and heat capacity of the soil. Thermal conductivity is found to be lowest for soils having a higher percentage of clay content. It has been found that the higher the clay content of the soil, the higher is the heat capacity. Thus, soils with higher clay content will be cooler in summer and warmer in winter (Biswas and Mukherjee 1987: 163). The temperature variation is highest in the uppermost soil layer and decreases with depth, and at a certain depth below (about 50 cm) the temperature variation is practically absent. At a depth of 3.6 m, the highest average temperature occurs in October and November (Smith 1932: 421-428). Thus, the underground soil temperature is favourable for grain storage in particular in the case of soils with a considerable amount of clay. Black soil contains a higher percentage of clay compared to other types of Indian soils. This may be one of the reasons why the majority of pit storage sites have been found in the black soil region.

It has been observed that grain losses vary from one geographic location to another and from one pit to another, depending on original grain conditions, season and associated organisms. A study on pit storage practised nowadays in Ethiopia, reports that grain losses vary from 2 to 25% for full pits and 7 to 35% for half pits (Dejene 2004: 8). The range of this variation is quite large. But 2% grain loss, during storage, is insignificant and it happens even in most modern storage systems. This study indicates that pit storage of grain is very site-specific and the characteristics of the soil are very important in selecting a location for underground storage.

Most pits found in India were either cylindrical or circular in shape and only at a few sites were rectangular pits found (Table 1). For a given volume, a cylinder or sphere has a lesser surface area than a rectangular parallelepiped. In case of underground pit storage of grains, surface to volume ratio is very important. With a lower surface area, there will be a reduction in the migration of moisture from the soil to the stored grain. A decrease in surface to volume ratio also reduces microbial contamination. The early practitioners of pit storage had certain conceptions of geometry which they applied in the construction of this type of storage system.

It has been observed that the underground storage system is most suitable for less developed countries as the cost of insecticides and fumigation can be avoided. Modified atmosphere (MA) can also be attained in this type of storage system without MA generators or gas cylinders thus reducing their cost. It is found to be the most suitable form of storage system for tropical countries where aeration with ambient air for cooling of grain is not feasible, grains get infested frequently and the available contact insecticides degrade rapidly because of high temperatures. In these conditions underground storage system is a good solution (http://www.agri.gov.il/Envir/hermetic.html accessed on 17.06.05.).

Table 2. Soil characteristics and the environmental pattern of different pit storage sites of ancient India

Type of Soil	**Site**	**Soil characteristics**			**Rainfall**	**Ambient**
		Alkaline/Acidic	**pH***	**Moisture Content (%)**	**(cm)**	**Temperature. (°C) Jan–July**
Deep Black soil	Inamgaon	Alkaline	7.6-8.8	17-25.5	40-60	20-25–25-27
	Daimabad				40-60	20-25–25-27.5
	Kaothe				40-60	20-25–27.5-30
	Nevasa				40-60	20-25–25-27.5
	Walki				40-60	20-25–22.5-25
Medium Black soil	Songaon	Alkaline	7.6-8.0	20-22	40-60	20-25–22.5-25
	Navadatoli				60-100	20-25–25-27.5
Mountain and Hill soil	Burzahom	Alkaline	7.2-7.45	10-12	100-150	0-10–0-20
Dessert soil	Kalibangan	Alkaline	7.5 - 8.3	5-7	20-40	10-15 above32.5
Red and Black soil	Gilund	Alkaline	7.6-8.15	17-20	60-100	15-20 27.5-30
Ferruginous Red soil	Balathal	Acidic	5.70-6.60	7-10	60-100	15-2027.5-30
Pedocal Sierozem of alluvial origin	Banawali	Alkaline	7.5-7.8	9-18	40-60	10-15 above 32.5
	Milathal					10-15 above 32.5
Alluvial soil developed in deltaic alluvium	Kuntasi	Acidic	6.0-6.6	9-18	40-60	15-20–30-32.5
Alluvial soilriverine (non-saline, non-calcareous to moderately calcareous)	Rangpur	Alkaline below 15 cm depth	7.10-8.52	9-18	60-100	20-25–27.5-30
Alluvial riverine highly calcareous	Ahar	Alkaline	7.7-8.4	13-15	40-60	10-15–25-27.5
	Sringaverpura				100-150	15-20–25-27.5
	Varanasi				100-150	15-2025-27.5
Alluvial riverine affected by salinity and alkalinity	Lal Qila	Alkaline	9.3-9.8	10-15	60-100	15-2025-27.5
Laterite soil	Mahisdal	Acidic	5.6-6.0	8-9	100-150	15-20 27.5-30

*pH variation is given with increase in depth
(*Sources:* Raychaudhuri 1963, Foth and Turk 1973, Biswas and Mukherjee 1987, *School Atlas* 2002.)

Conclusion

It can be assumed that the early cultures which practised underground storage systems, were aware of the scientific and technological elements in this system. The structure of the pit, method of plastering and choice of a suitable depth testify to this. The use of lime plaster in shallow pits within black soil, and in storage pits within acidic soils such as at Balathal are good examples. They were aware of the fact that lime plaster reduces microbial formation. They were also aware of the difference in subsoil and atmospheric temperature, and thus used pits with depths more than 0.5 m as the subsoil temperature below 0.3 m differs from the surface temperature. Most pit storage systems are located within black soils, which are conducive to the practise of underground storage. Pit storage is practised even today at some of these sites such as at Inamgaon.

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Towards an Understanding of Medieval Glazed Pottery Manufacture from Lashkarshah, Khambhat, Gujarat

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Abstract

This paper discusses glazed pottery manufacture on the basis of analysis of the craft residue collected during surface surveys of a medieval production centre at Lashkarshah, Khambhat, Gujarat. Though glazed pottery has been reported from a large number of sites in India, Lashkarshah is the only site reported which has revealed evidence indicating its importance as a major production centre. The reason for not being able to locate other production centres elsewhere is possibly owing to the unfamiliarity of archaeologists with craft indicators. This paper also tries to address these questions; and highlights various craft indicators archaeologists should look for in order to identify glaze-manufacturing centres.

Introduction

Glazed ware can be defined as pottery, the body of which is coated with a layer of glassy coating, either to make it impermeable or for decorative effects. Surface surveys and explorations at number of sites have yielded glazed pottery[1]. Though this ware has been extensively used in India during the medieval period and a large number of buildings have been beautified by glazed tiles interestingly factory sites or production centres have eluded archaeologists.

Lashkarshah in Khambhat[2] is the only site in India that so far has revealed indications of being a very important production centre of glazed pottery manufacture during medieval times. Reconstructing the technology of manufacture by studying various craft indicators at the site forms the basis of this paper.

Background

In India, glazed ware of the type discussed in this paper, is associated with the medieval period (Mohammed 1985: 105). At Hastinapur, it was found in levels contemporary with and posterior to the coins of Balban (A.D. 1206-87) (Lal 1954-55). The excavations at Purana Qila report glazed ware associated with coins of Balban and Muhammad Tughlak (IAR 1969-70: 4). The earliest glazed tile decoration in medieval India dates back to the 12th and 13th century A.D. Many tombs in Multan, especially of Yasuf Gardizi (1150 A.D.), Shamsuddin Tabrizi, Bahaul Haque (AD. 1226-1280) and Ruknuddin are covered with glazed tiles (Cunningham 1875: 132-133).

However, the art of glazing in India can be traced back to the Indus Civilisation. From excavations at Mohenjo-daro, Marshall (1973: 686-687) reports glazed ware. Similarly, excavations at Desalpur in Kachchh yielded a few sherds of glazed ware (IAR 1963-64: 11). The production of Reserved Slipped Ware found in comparatively large quantities from the Harappan sites in Kachchh and Saurashtra appears to be the earliest glazed ware in India. In fact, glaze is one of a wider group of vitreous materials including faience, glass and enamel. Therefore, the production of glazed ware was undoubtedly within the technological know-how of Harappan artisans; therefore finding glaze from these sites is not at all surprising. The artisans of Egypt, Mesopotamia and the Indus Valley were creating faience and glazes using several techniques by 2600 B.C. (McCarthy and Vandiver 1990).

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[1] Glazed ware has been reported from Fathepur Sikri, Champaner, Purana Quila, Adilabad, Vijaanmandal, Khilokheri, Atranjikhera, Baxar, Nagara, Oriup, Panna, Daulatpur, Sangol, Jahanpana, Qila-ri-Pithora, Nevasa, Borach, Jajman, Ropar, Ujjain, Bahal, Pataliputra, Chirand, Kurushkshetra, Hoshirpur, Kaseri, Manwan and many other sites in India (Mohammed 1985 106)

[2] Khambhat (22° 19' N; 72° 33' E) a taluka town, is situated at the tip of the Gulf of the Khambhat, where the rivers Mahi and Sabarmati flow into the sea. The port of Bharuch (*Barygaza*), was the major port during the 1st and 3rd centuries A.D and continued to be important until the Arab invasion around the 7th century A D From the 10th century A.D. to the 17th century A.D , the city of Khambhat functioned as an effective port (Janki 1980: 5). However, its importance fluctuated with the periodic silting and clearing of tidal channels that allow the ship's access into the Gulf of Khambhat.

Furthermore, excavations at Shah-Ji-Ki-Dheri near Peshawar, have revealed a monastery and stupa, the construction of which is attributed to Kanishka. It is remarkable that this structure has a Kharoshti inscription with a glaze over it (Spooner 1908-9: 55). Buddhist shrines dated to the Kushana period excavated at Harwan, near the Dal Lake in Srinagar were paved with glazed tiles (Vogel 1962-63). Pre- Sultanate tiles and pottery were found in Gaur and Pandua in Bengal (Furnival 1904) and Brahmanabad (Mohammed 1985: 105) in Sindh. These are different from the blue, diapered and banded tiles and pottery that came to be used during the medieval period.

Surface Survey at Lashkarshah

Lashkarshah (22° 18' N; 72° 37' 23 69" E) is situated 1 km southeast of the ancient fortified town of Khambhat. The craft indicators of glaze production are spread over a very large area. However, with ever expanding structural activities of the Khambhat town, a large area of the site has been engulfed by modern building activities. The site is literally littered with thousands of craft residues; suggesting that it was a huge production centre of glazed pottery during the early 14-16th century A.D., if not earlier. Janki (1980: 26-28) mentions Khambhat as a production centre of clay utensils during the 16th century. A large number of craft indicators of glaze manufacture were collected over a period of time during several visits along with postgraduate students of the department. The analysis of these indicators helped us in reconstructing the manufacturing process of glazing. The craft indicators included:

(1) Setters (Fig. 1)
(2) Setters' sticking to glazed ware (Fig. 2)
(3) Vitrified/melted clay kiln - lining (Fig. 3)
(4) Stone crushers (Fig. 4)
(5) Small vessel containing lime (Fig. 5)
(6) Wrapped and joined vessels (Fig. 6)
(7) Clay nozzles/tuyeres (Fig. 7)
(8) Unglazed and glazed ware (Fig. 8)
(9) Decorative glazed ware (Fig. 9)
(10) Defective glazed ware (Fig. 10)

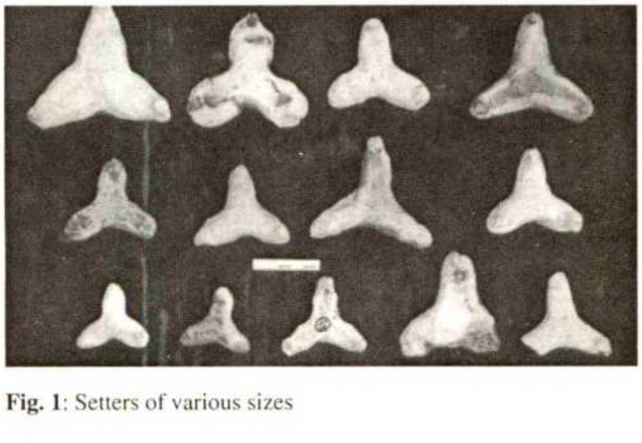

Fig. 1: Setters of various sizes

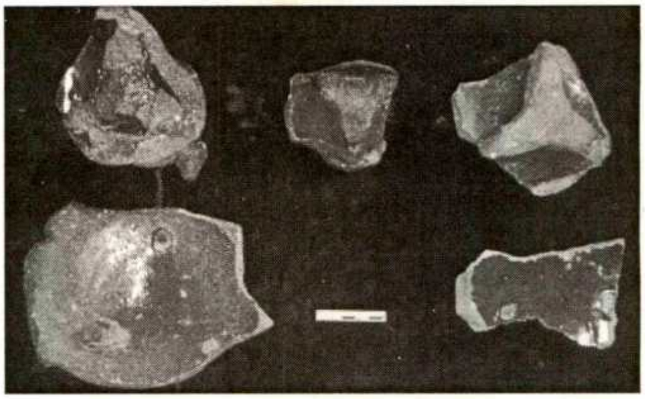

Fig. 2: Setters' sticking to glazed ware

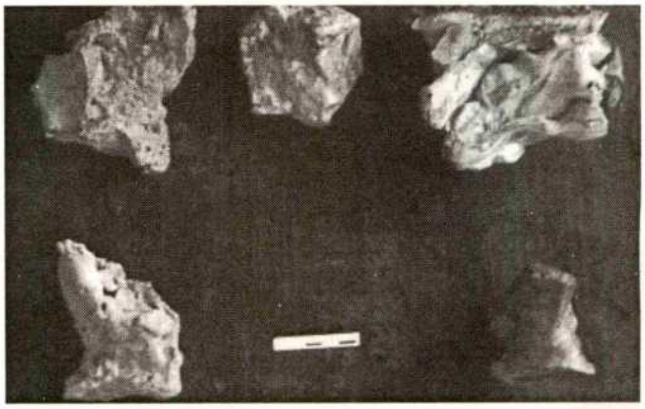

Fig. 3: Vitrified/melted clay kiln-lining

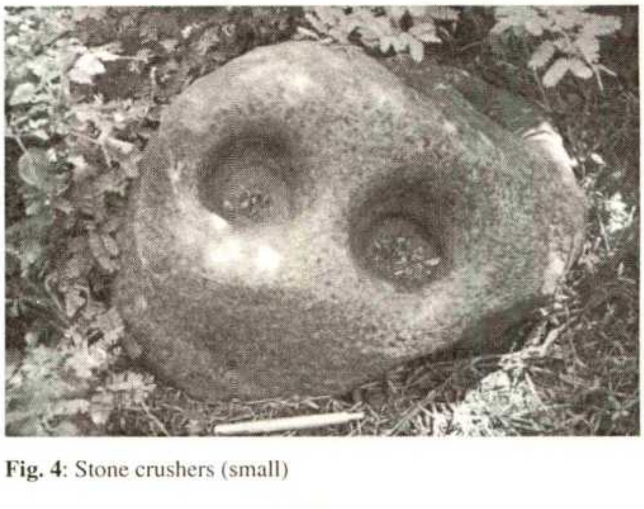

Fig. 4: Stone crushers (small)

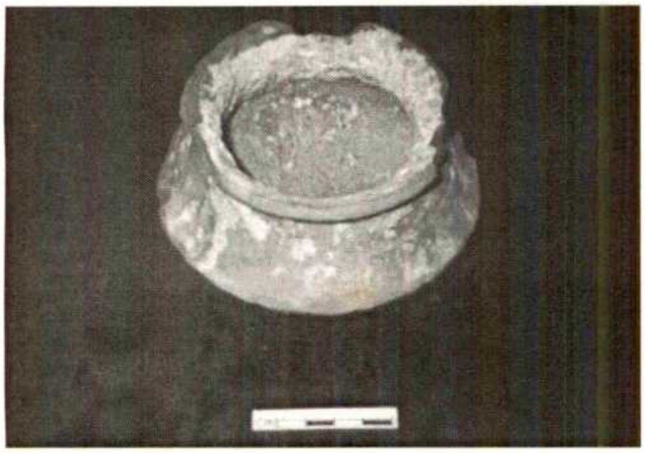

Fig. 5: Vessel containing lime

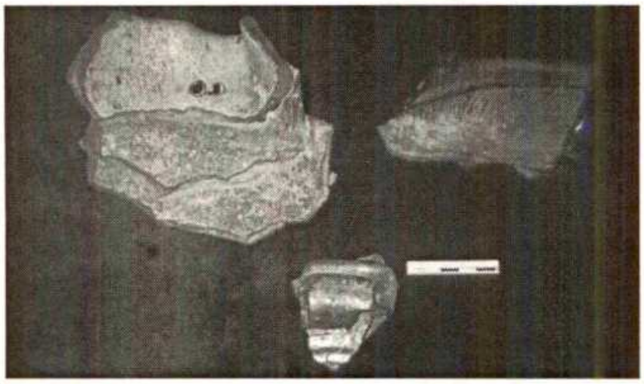

Fig. 6: Wrapped and joined vessels

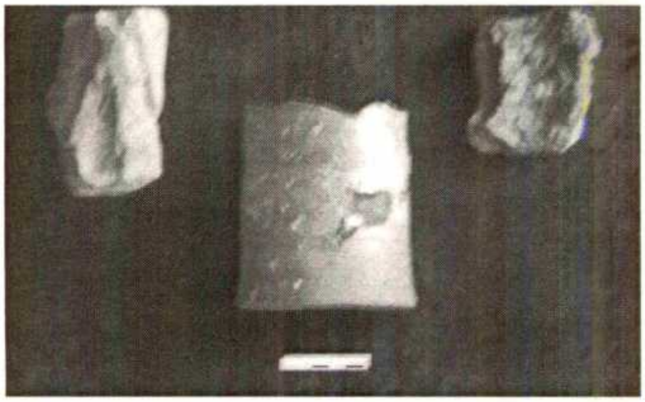

Fig. 7: Clay nozzles/tuyeres

What is a glaze?

As mentioned earlier, a glaze is a vitreous coating applied to the surface of wares, either to make them impermeable or for decorative effects. Physically, these vitreous substances are super-cooled liquids; that is to say, they are

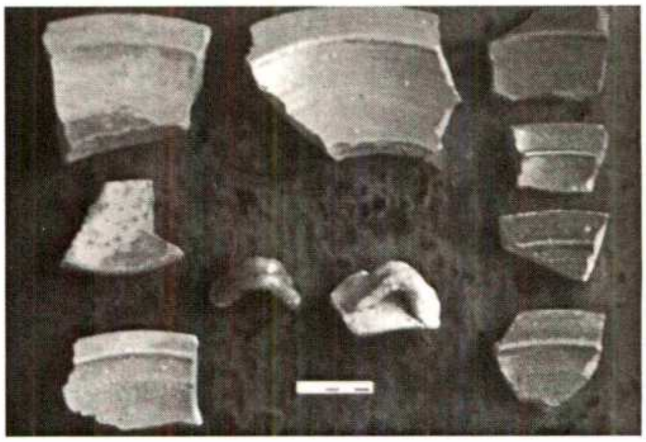

Fig. 8: Unglazed and glazed ware

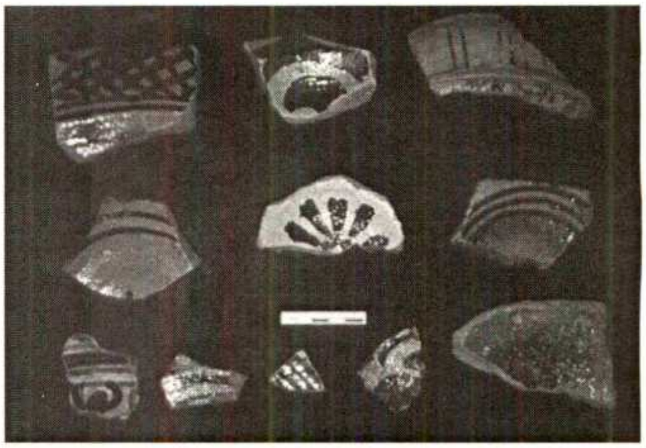

Fig. 9: Decorative glazed ware

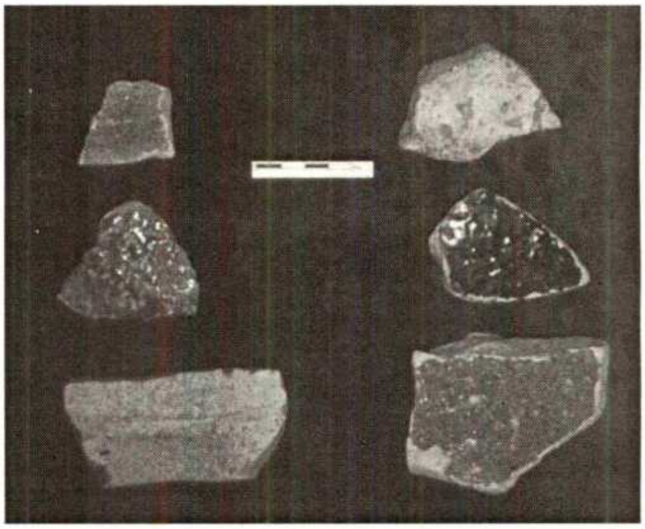

Fig. 10: Defective glazed ware

liquids of very high viscosity at normal temperatures, and thus in a solid state they are not crystalline.

Glaze formers and modifiers

A number of organic oxides have the ability to form glassy materials, including silica. Since silica is present in all ceramic bodies, the silica for glazes is derived from this source. Silica melts at 1710 °C, and since the temperature is far in excess than that obtained in a sample kiln, the silica must be modified with a flux to form the glaze. A number of metallic oxides have the ability to act as fluxes to produce a stable glaze. They include oxides of iron, sodium, potassium, lead, calcium, magnesium, zinc and aluminium (Hodges 1971: 43-44). Therefore, only modifiers have to be applied to the surface of the pottery, and this reacts with the silica present in ceramic bodies; at the surface to form the glaze.

In the absence of any analytical studies it is not possible to determine the fluxes used at Lashkarshah. In traditional glazed tile technology and glass production of South Asia, two types of fluxes that are still used are potassium and sodium. The primary flux for melting silica is an alkaline ash derived from burning of desert plants, generally referred to as camel thorn *(Haloxylon recurvum, H. multiflorum*, Sal – *Sola foetida, Suaeda fruticosa*) (Rye and Evans 1976). The ash thus obtained is called *sajji* or *khar*. Another type of flux used in glazing is naturally occurring sodium carbonate/ bicarbonate, commonly referred as to as *natron* (Urdu – *reh*) (Kenoyer 1994). A vessel recovered (Fig. 5) on preliminary analysis was found to contain lime. Perhaps this was also used as a flux in the production of glaze at Lashkarshah. The source of calcium oxide was from calcium carbonate added as chalk, or limestone. Other sources are calcium sulphate (gypsum) or bone ash, which contains calcium phosphate and calcium carbonate. Oxides of copper, iron or manganese can also be used as glaze modifiers and though they help to lower the fusion point of silica, their primary function appears to have been for colour.

Glaze application

Although some glazes may be formed by applying dry materials from which the glaze modifier is to be derived directly to the surface of the vessel, it is far more common to apply a glaze as a suspension of fine particles in water, with or without adhesive. Any glaze in which the raw materials are simply ground and applied in this way is called *raw-glaze*. For a number of reasons many raw materials cannot be applied in this way (Hodges 1971: 47). All the sodium, and potassium compounds, which were used perhaps at Lashkarshah, are soluble in water, and if applied directly to the ware would be absorbed by the body rather than remain on the surface. To overcome this difficulty, raw materials (in this case *Khar/reh*) are fused (fritted) in a crucible to from insoluble glass, or frit. This material is pulverised, suspended in water and applied over the surface of the vessel. Other raw materials like calcium carbonate (lime) or calcium sulphate (gypsum) give off gases – carbon dioxide and sulphur dioxide respectively, at high temperatures and these cause blisters in the glaze. This difficulty is also overcome by getting rid of these gasses while *fritting*. However, this problem can also be overcome by applying these fluxes directly on to the fired pottery.

Though, we have not discovered any crucible at Lashkarshah, the recovery of a vessel containing lime, the traditional use of *khar* or *reh* in South Asian glaze manufacturing, and of crushing stones used for pulverising, probably indicate that *khar*, *reh* and lime were used as glaze modifiers. Nevertheless, we may have to wait for the analysis of the glaze to identify modifiers used at the site.

Glaze colourants

Drab green, blue, red and brown colour glazes were found at Lashkarshah (Fig. 9). Many metallic oxides act as colorants in the production of glaze. When fired under oxidizing conditions, iron oxide colours glazes yellow, red, or brown, depending upon the quantity present. While under reducing conditions, it produces greens. Any ores from which iron is smelted may be ground and added to glaze. Copper oxide is another common raw material for blue or green glazes, depending on which modifier is present. If lead oxide is used as a modifier, copper oxide gives a green glaze, and with sodium (*reh*) or potassium (*sajji/ khar*) the colour will be blue. Cobalt oxide derived from ashbolite, an impure form of manganese, gives a clear blue as typified in early blue-and-white chinaware. For purple brown, violet and black colours manganese oxide is used, and the colours depend on the type of modifiers used in the flux.

Decorative glaze

A few glazed potsherds recovered from Lashkarshah were decorated with underglaze decorations (Fig. 8). When glaze ware is to be decorated in colour, the colouring materials are applied first directly on to the green -hard or fired vessels before glazing. These underglaze *decorations* must be such as to withstand the temperature at which the glazed ware will be fired. In general the colours are painted on, either as suspension in water, or mixed with adhesives or oils. In the latter case it is essential to burn out the adhesives or oils in low-temperature ovens before applying the glaze, a process known as hardening on firing. Most of the times underglaze decorations are covered by a transparent glaze so that the patterns underneath are visible (Hodges 1971: 47).

Only one glazed potsherd from Lashkarshah revealed on-glaze or over-glaze decoration. Such decorations may be applied either to already fired ware that has been glazed. The over-glaze decorations can be easily identified because in over-glazing there is a tendency for colours to run into the glaze producing fuzzy edges around the coloured area.

The first essential step in making a good glaze is to reduce all the ingredients to a sufficiently fine particle size. The recovery of crushing stones (Fig. 4) with a series of deep depressions perhaps indicates crushing of ingredients. The crushed ingredients were either elutriated or passed through a fine -mesh screen to remove large particles. Today potters use simple chemical concepts to foretell the characteristics of any glaze prepared. This of course, was not the case in antiquity. The formation of any glaze had to be arrived at by trial and error; and when one considers the probable cost of such experimentation to the potter, it is hardly surprising that once a satisfactory glaze was devised it remained in use, unaltered, over a long period. Even today the greatest single difficulty for the potter is to devise a glaze that will contract on cooling to the same degree as the body to which it is applied. This 'unpredictable' nature of the glaze results in lot of failures creating large amounts of debris around such manufacturing centres.

Drying and firing

When glaze materials are not applied in a dry state, the liquid glaze may be sprayed on wares, or wares may be dipped in the fluid as was the case at Lashkarshah, Applying glaze with a brush (although practised), results in a very uneven coating. After the wares are allowed to dry, they are placed on setters (Fig. 1) to prevent their sticking to the bats or shelves or to other vessels on which they are stacked during firing.

Lashkarshah is littered with thousands of setters of various sizes, some of them found sticking to vessels (Fig. 2). Since glazed ware needs to be protected from the direct flame and if muffle kilns[3] are not used, they are placed in lidded boxes. These lidded boxes are saggers. As it is obviously economically necessary to pack as much pottery into the kiln for each firing as possible, a number of small refectory supports, generally known as setters, are used to keep wares separated from one another, or from bats or shelves, on which they stand. These setters vary considerably in shape and size. But all share the common design in that the actual surface area of the setters that comes in contact with the ware is kept at a minimum. After firing these setters must be detached from the glazed ware leaving a blemish. Thus each firing produces literally hundreds of setters that cannot be used again, and therefore form the most prominent craft indicator at manufacturing sites.

At Lashkarshah, setters were trefoil in shape. Each arm is raised and forms broken pointed ends, some of which still have glaze sticking to them, thereby suggesting that they were being used as setters. The recovery of setters from the site perhaps suggests that the muffle kiln was not used; instead glazed wares were fired in a conventional up draft kiln. Wares were set in kilns stacked on the setters. The recovery of clay nozzles/ tuyeres (Fig. 6) indicates that air directed into the kiln by means of clay nozzles using skin or drum bellows.

During firing the glaze should not only melt but ideally run evenly over the surface of the wares. The temperature at which this takes place is known as the maturing point of the glaze, and is slightly higher than the melting point.

Defective glaze

A few potsherds having pinhole pits were recovered from the site (Fig. 10). Such defective glazes commonly occur due to evolution of gasses from the body during firing, which puncture the molten glaze. Air or water in the body also produces similar effects. as rapid firing will invariably emanate gasses.

Concluding Remarks

Over the years any glaze production centre will produce a mass of wasters that include melted clay, linings of the kilns (Fig. 3), saggers, and setters that have been detached by percussion after the glazed ware has been removed from the kiln. Setters still sticking to the bases of vessels (Fig. 2), defective glazed wares (Fig. 10), etc. are also produced owing to firing mishaps. This may also result in warping and joining of vessels (Fig. 6) generally due to the uneven distribution of heat within the kiln casing; for example one side of a vessel contracts more than the other on cooling. On the other hand, sagging or squatting is due to firing above the maturation point and so allowing wares to melt partially. Such wasters and defective wares have no commercial value and thus accumulate around the kiln and workshop areas. An archaeologist should be able to recognise this material. Often archaeologists while examining particular structures fail to recognise this detritus of a potters workshop, and thus miss valuable evidence.

Acknowledgements

I am thankful to Dr. Massimo Vidale who for the first time drew my attention towards one of the important craft indicators during our ethnographic study in 1989 at

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[3] A muffle-kiln is a structure in which flames of the fire are prevented from coming in contact with the pottery by internal wall, floor and roof, and are primarily used in firing glazed and similar wares.

Khambhat. I would also like to thank all the M.A students who visited the site for their ethnographic training. Children of the Lashkarshah neighbourhood also deserve thanks for not only helping me collect material, but who also willingly shared their collections with me.

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Book Review

Palaeography of Orissa. by Subrata Kumar Acharya 2005. New Delhi: D.K. Printworld. Pages 340, Price Rs. 1440/- US. $70.

The book is a revised version of the doctoral research of the author which was submitted to the Sambalpur University in 1992. The outcome of this research has been incorporated in ten chapters, besides the chapters devoted to introduction and conclusion. The basic concept of the research revolves around the development of Oriya script from the beginning of the writing found in ancient Orissa from around the second half of the third century B.C. During this period a major part of present-day Orissa was known as Kalinga and was an important political unit in the subcontinent. It was a neighbouring country of Magadha, one of the most powerful political and cultural centres, from where cultural traits and ideas dispersed to various part of the subcontinent. Kalinga, being an important political division could have participated in this exchange of ideas.

Soon after the Kalinga war, writing is clearly seen in public places and was probably meant more for people already well versed with the language and the script. The pre-Mauryan evidence still alludes us, except for the evidence from Anuradhapur in Sri Lanka.

Once a beginning was made in Kalinga, there was no looking back. Looking at geo-political configurations, Kalinga had a peculiar way of responding to regional development. When it accepted or was influenced by cultural traits, this geo-political region nurtured and developed them with a regional abeyance, and produced and manifested these within a regional framework. This distinctiveness can be observed in the development of Kalingan or Orissan art and architecture and also in dance forms. Dr. Acharya's research on Orissan palaeography further establishes this unique regional character. His dedication, understanding and commitment in studying 'several hundreds of copper-plates and stone inscriptions' established for the first time, the evolutionary characters of the Oriya script from the 3rd century B.C. to the seventeenth century A.D.

The introduction chapter is provided with a brief historiography of the development of palaeographical studies in India, from the early part of nineteenth century under James Prinsep, to recent times. His critical observations bring out several stages in the conceptual development of understanding palaeography in the subcontinent; and also as regards regional studies in Orissa. This development lays emphasis on palaeographical studies focussing on regional geo-political forces at micro-levels, partly shaping writing styles and regional linguistic variability. His observations on individual and local mannerisms under different political units, political ideology, segregation, medium of writing, instruments used and hereditary nature of scribes are noteworthy. In the subsequent chapter, he describes the nature and micro-variation in the Imperial Brahmi script in Orissa and suggests that no regional variety existed and if any deviation is noticed it was probably due to circumstantial disadvantages. The third chapter reviews the on transitional phase and later Brahmi scripts in Orissa from the time of the Hatigumpha inscription of Kharavela to the early centuries of the Christian era. The script has undergone considerable change as seen in the use of head-marks, diacritical notations, cursive forms and tendency towards ornamentation. The paucity of records during the first century B.C. to around the third century A.D. makes it difficult to satisfactorily evaluate the evolution of script in Orissa. The next chapter deals with median Kalinga script of the fourth and fifth century A.D. Independent, well-established sub-regional territorial dynasties had already emerged. Inscriptions reveal contemporary political interrelationships, first with the Satavahans in the west, and Kushanas and Guptas in the north. Though, there are only a few records pertaining to this period, Acharya's observations tells us that the script underwent considerable regional changes to accommodate Sanskrit orthography, conjuncts and nasals, along with a general trend of change taking place in the overall transformation of the script elsewhere.

In subsequent chapters, the author traces the development of palaeography in Orissa in a more regional manner. He sub-divides regions on the basis of evidence of palaeographical and geo-political systems operating in south Kosala, Tosali, Utkala and Kongoda. The availability of a large number of epigraphic documents during this period, facilitates the study towards understanding the regional behaviour and external influences. A few dedicatory records in temples are mostly land grants for learned Brahmins migrating or re-settling from the locales within the state or from different parts of the country, especially from the northern India. The next three chapters deal with the Kutila script in Tosali, Proto-Nagari script in Orissa and mixed Kalinga script. The palaeography of the period not only show absorption of trends coming from various quarters, but also signatures of regional consolidation and a desire for the emergence of sub-regional and broader regional peculiarities. This was the period where a lot of interaction between regional powers was witnessed along with the movement of people with different cultural and ethnic background. A mosaic regional identity arose which can be seen in socio-cultural and economic interactions and in the building of a large number of religious monuments having strong regional characteristics. The next chapter on the proto-Nagari script in Orissa (chapter eight) is quite exhaustive taking into account nearly 150 inscriptions of the major regional power, Bhaumakaras and contemporary small territorial chieftains such as the Bhanjas and Sulkis. This is the period when a large number of learned Brahmins migrated or resettled in the hilly-forested hinterlands in the northwestern region of the state, with the help of generous land grants from ruling dynasties. The palaeography of this tenth-eleventh century period often termed as the eastern variety of the northern type, old Nagari type or Kalinga Nagari. The proto-Oriya script emerged from this peculiar regional characteristic and its constant use and gradual evolution influenced by individual and geo-political powers. Acharya has clearly demonstrated through this analysis and meticulously prepared charts, the evolutionary process from proto-Nagari to proto-Oriya. Further, his observation on the development of a proto-Nagari script in western Deccan, which travelled to Kanauj and hence to eastern India, is situated within a socio-economic and cultural context.

The next chapter deals with mixed the Kalinga script. The southern part of Kalinga showed palaeographical distinctiveness from an early stage. The scripts of Kalinga were constantly influenced by emerging traits of neighbouring palaeographical zones.

The tenth chapter deals with the proto-Oriya script. This is the most crucial period of development of the present Oriya script beginning around the latter part the eleventh century. The gradual growth is seen for at least the next three centuries, till it established independent morphological characters, forms, use of consonants and conjuncts. The last chapter deals with the 'Early and Modern Oriya Script'.

The essence of Acharya's study of the palaeography of Orissa is his critical observation of the micro changes it underwent through time owing to geographical, political, episodic external influences through cultural intercourse, distinctive urban and rural writings habits/characteristic procedures; etc. His observation and comparison of styles of writing between the Bhaumakaras and their feudatories, shows that people in the hinterland used a simplified, less stylised form which became the favoured script in the subsequent period as it was easy to engrave. The result was the evolution of a regional proto-Nagari script. This lasted for about two centuries till the end of the eleventh century. By then, the proto-Oriya character was visible.

Acharya's research reveals not only the morphological development of Oriya script but tells us the passage it has travelled through to achieve this distinct form. He has indirectly shown that the same inferences can be traced from archaeological and historical records, all it was in past. This book will serve as a valuable source for scholars working on Orissan history, language and culture.

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Conference Report

Report of the International Conference at Kazan (Tatar Republic, Russia), 12-17, September 2005

The National Museum of Tatar Republic, Kazan (Russia) celebrated 110th year of its foundation in 2005. This year also coincided with millennium years of the city of Kazan. Kazan University has been a home to writers, poets, philosophers and painters like Gorky, Tolstoy, Pushkin and Shaljapin to name a few, a testimony to great literary and scientific traditions, hitherto little known to the non-Russian world. "*Kazan Millennium*" was a key word of the year for the residents of this capital city of Tatar Republic. The whole city geared up for the year round celebrations to the extent that even the streets and every public structure was decorated with flags of Russia, Tatar Republic and Kazan city to mark the celebrations of *Kazan Millennium*.

As part of the celebrations of '*Kazan Millennium*" the Tatar Republic Ministry for Culture, National Museum of Tatar Republic with the assistance of the Millennium Committee under the auspices of *Kazan Millennium*, ICOM and the Union of the Museums of Russia recently organised an international scientific conference. The conference entitled "A Contemporary Museum as an Indispensable Source of the Development of the City and the Region on the Whole" It was held at the National Museum, Kazan (Tatar Republic, Russia) from 12th to 17th September 2005. Conference organisers, Dr. Z.R. Valeeva (the Tatarstan Minister for culture), Dr. G.S. Mukhanov, the Director General; Dr. Nazipova, Assistant Director of the National Museum, and Ms. Tatiana Desyatkova, Conference Secretary made the event one of the finest academic endeavours. The conference began with a tour to the city with an objective of introducing the rich cultural heritage to the delegates and even at some of these places of archaeological significance discussions provided a glimpse of 'open air' conference proceedings. A total of 219 participants representing practically every state or republic of the erstwhile USSR presented papers on various aspects of museum research. The theme of the conference primarily focused on the following issues:

1. Theoretical and practical aspects of the museum business
2. Natural history, archaeological, ethnographical and historical research as the basis of museum activities
3. Museums in terms of budgetary restructurisation
4. The role of museums in the making of a tolerant society
5. The image making mission of museums
6. The high-tech in museum's employ
7. Museums and web sites, and viability and authenticity of internet publicity in museum research
8. Marketing as a means of interaction of museum and society
9. Effective management as an optimising means of integration of museum, culture and society

The brain storming sessions on various issues of museums, including Internet and publicity media evoked great interest and academic vigour. Sessions pertaining to archaeology and Natural History included a good number of papers. Dr. Vijay Sathe of the Deccan College, Pune, India was the sole non-Russian speaker at the conference, who presented a couple of rare examples of digenesis and enamel dysplasia from a museum collection in Delhi. In his preliminary report of the fossil collection, he described a record of supposedly rapid burial of a deer dentition and also explained the rare evidence of lack of abrasivity co-efficient in the diet of an elephant of Lower Pleistocene period. Dr. Bogatkina, an archaeozoologist from the National Museum, Kazan presented her findings of medieval burial sacrificial fauna of Chepetskaya Culture. Horse was found to be a major sacrificial animal while squirrel finds a symbolic representation. Her study traces the history of modern ethnographic traditions of Udmurts. Soroka and others in their paper 'The metamorphosis of Kaluzhsky mammoth' provide an interesting tale of a missed identification of an elephant skeleton. It was found near Kaluzhskaya Square, Moscow in 1899 and was thought to be of a mammoth. Re-examination of the skeleton in addition to the carbon dating reveals it to be of an African elephant buried about 200 years ago. Yet another paper by Starodoubtseva and Mitta on the palaeontological records in Vernadsky's State Geological Museum highlights its recent publications and solicits further study and discussions on a large palaeontological collections housed in their museum. Novikova in her paper

'From the history of the Dept. of Natural history of the National Museum of the Republic of Tatarstan', paid a rich tribute to the history of the National Museum's Natural History Department.

On 17th of Sepember, a day-long excursion was organised to a medieval site of Yelabuga, about four hour's drive from Kazan. Yelabuga is once again a world of museums and heritage conservation. Several museums were visited and the narratives regarding the museum exhibits practically brought into life the person in whose memory the museum was dedicated. The Museums especially dedicated to the great figures of Russia viz. Tsvetaeva (Poetess), Shishkin (Painter) and Durova (cavalry-woman) are the hallmarks of aesthetics and scholarships in the art and science of Museology. An additional visit to Raeefa, a 17th century holy shrine of virgin mother and an exposure to Tatarstan countryside were an optical celebration.

The conference proceedings have already been published, providing an update of recent researches in the field of museums and its allied branches. Though in Russian, the Volume is a welcome addition to any institute interested in pursuits of interdisciplinary researches in Museology.

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Report of the General Secretary, *Man and Environment* XXXI(2). 100-103 [2006]
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Indian Society for Prehistoric and Quaternary Studies
C/o Department of Archaeology, Deccan College, Pune 411006.

Report of the General Secretary for 2005-2006 (01-04-2005 to 31-03-2006)

The functioning of the Society during the year ending on 31-3-2006 has been quite satisfactory, both academically and financially. The regular activities of the Society were carried out successfully. The financial position is reasonably sound because of the interest accruing on the fixed deposits and annual grant for publication of the Society's Journal Man and Environment as well as for organising the annual conference from the Indian Council of Historical Research (ICHR) and Archaeological Survey of India (ASI). We are grateful to ICHR and ASI for financial support. The audited statement of accounts for the period ending 31-03-2006 is printed in this Volume (XXXI, No. 2) of the Society's Journal, *Man and Environment.*

Man and Environment

This is the thirty-first year of the publication of the Journal and nineteenth year of its biannual publication. The Journal has maintained its standard and continues to attract a wide range of manuscripts by scholars from within and outside the country. The circulation of the Journal is steadily increasing.

We sincerely thank Mr. Sujit Patwardhan, Mr. Narendra Kulkarni and other staff of Mudra Press, Pune for their excellent cooperation in the production of the Journal.

Annual Conference

The XXXIII Annual Conference of the Society was held, in conjunction with the XXXIX Annual Conference of the Indian Archaeological Society, XXIX Annual Conference of the Indian History and Culture Society, XXXII Annual Conference of Epigraphical Society of India, XXVI Annual Conference of the Place Names Society of India and the National Seminar on Beginning of Agriculture and Village Settlements in India: Recent Archaeological and Scientific Investigations. The joint conference was organized by the M.H. Krishna Institute of Indology, Bangalore, Department of Sanskrit, Bangalore University and the Directorate of Archaeology and Museums, Government of Karnataka under the overall leadership of Professor S. Nagaraju, Director, M.H. Krishna Institute of Indology.

The following life members of the Society participated in the conference:

S.R. Adhyapak, Kumar Akhilesh, Shahida Ansari, S.K. Aruni, Arati Deshpande-Mukherjee, Subrato Chakrabarti, S.G. Charusmita, Kurush Dalal, Rhea Mitra Dalal, A. Dandekar, P.P. Dandwate, Nupur Dasgupta, Hemant Dave, Sushma Deo, P. Binodini Devi, K.N. Dikshit, D.P. Dubey, S.P. Ganvir, Savita Ghate, S.S. Gore. M.C. Gupta, S.P. Gupta, S.S. Jadhav, Shehnaj Husne Jahan, M. Jaishri, Jaya Jose, P.P. Joglekar, P.S. Joshi, P.M. Kabragode, M.D. Kajale, Alok Kanungo, Giriraj Kumar, Manoj Kumar, K. Madhavi, Anup Mishra, Sheila Mishra, V.D. Misra, V.N. Misra, R.K. Mohanty, Malti Nagar, Rukshana Nanji, V. Nautiyal, S.B. Ota, J.N. Pal, R.P. Pandey, S. Pandya, Shanti Pappu, Sadasiba Pradhan, A.K. Prasad, K. Rajan, P. Rajendran, Anjana Reddy, Vijay Sathe, T. Satyamurthy, V. Selvakumar, Bratiti Sen, R.K. Sharma, M.L. Sharma, Pranab J. Sharma, V. S. Shinde, K.S. Shukla, A.K. Singh, B.P. Singh, Sharada Srinivasan, Chanchala Srivastava, Rakesh K. Srivastava, J.P. Srivastava, V.H. Sonawane, V.S. Soni, A. Sundara, N. Taherm, Devi Prasad Tewari, P.K. Thomas, Alok Tripathi, Shipra R. Upadhyaya and Aokumla Walling.

Inaugural Function

The inaugural function of the joint annual conference of the five societies was held on 15th December 2005 at the Jnana Jyothi Auditorium, Central College Campus, Bangalore. H.H. Sri Sri Ravi Shankar, Founder, Art of Living Foundation, Bangalore was the chief guest. Professor D.N. Tripathi, Chairman, Indian Council of Historical Research, New Delhi inaugurated the joint conference. Other dignitaries present on the occasion are Professor M. Thimmappa, Vice-Chancellor, Bangalore University, Professor S. Nagaraju, Organising Secretary of the Conference, Shri K.N. Dikshit, General Secretary, Indian Archaeological Society, Dr. Vandana Kaushik, General Secretary, Indian History and Culture Society, and Dr. P.K. Thomas, General Secretary, Indian Society for Prehistoric and Quaternary Studies.

Presidential Address

The Presidential Address of the Society was delivered by Professor M.L.K. Murty, former director, Centre for Regional Studies, School of Social Sciences, University of Hyderabad on "Prehistoric Archaeology in India: Recent Trends in Method and Theory".

Professor H.D. Sankalia Memorial Lecture

The fifteenth Professor H.D. Sankalia Memorial Lecture was to be delivered by Prof. S.N. Rajaguru, Retired Joint-Director, Deccan College Post-Graduate and Research Institute, Pune. Due to some unavoidable circumstances Prof. Rajaguru could not attend the Conference.

Dr. Malti Nagar Ethnoarchaeology Award

The following papers were presented for this award:

Dr. Sharada Srinivasan: Megalithic High Tin Bronzes: Ethnoarchaeological and Archaeometallurgical Insights on Manufacture and Possible Artistic and Musical Significance.

Ms. Anjana Reddy: From 'Banda' to 'Bailu' (the Hills to the Plains): An Ethnoarchaeological Approach to Settlement Patterns of the Chenchus of the Nallamalai Hills, Andhra Pradesh.

These papers were sent to three eminent experts for their evaluation. After presentation at the Conference, the panel of judges nominated by the Society's Executive Committee, namely Professors M.L.K. Murty, V.H. Sonawane and V.D. Misra, unanimously recommended both the papers by Dr. Sharada Srinivasan and Ms. Anjana Reddy for Dr. Malti Nagar Ethnoarchaeology Award.

The Academic Sessions

The academic sessions of the conference were held between 16-18 December 2005 and the following papers were presented:

Savita Ghate: Geomorphological and Geoarchaeological Changes along the Konkan Coast during the Holocene – A Review.

Sushama Deo, S.N. Rajaguru, P.P. Joglekar, Arati Deshpande-Mukherjee and Pandurang Balakawade: Quaternary Hydrological Changes in the Mutha Basin, District Pune: Glimpses from Salvage Work.

P. Rajendran, Peter Koshy and K. Chandra Kumar: SEM study of a Middle Pleistocene Human Fossil.

M.D. Kajale and S.D. Sathe: Late Quaternary Palaeoecological Excavation and Palaeoenvironmental Studies at Tadula, Manjra Valley, Maharashtra.

Shanti Pappu and Kumar Akhilesh: Excavations at the Prehistoric Site of Attirampakkam: The Regional Context.

Giriraj Kumar: Lower Palaeolithic Petroglyphs and Hammer Stones from the Excavation at Daraki-Chattan.

V.H. Sonawane *et al.*: Excavation at Bagasara – 2004-2005: A Preliminary Report.

Anujot Singh Soni and Vidwan Singh Soni: Preliminary report on the Excavation of an Epipalaeolithic site complex in the Sivaliks of Himachal Pradesh.

R.K. Mohanty: Excavations and Reconstruction of Megalithic Burial at IGRMS Campus, Bhopal.

K. Rajan: Excavations at Thandikudi, Tamil Nadu.

R.K. Mohanty and Tilok Thakuria: A Comparative Study of Beads from Vidarbha Megaliths, Maharashtra.

V. Selvakumar and K.P. Shajan: Recent Investigations at the Site of Pattanam (Muziris?), Kerala.

J.N. Pal and M.C. Gupta: Excavations at Hetapatti (Allahabad).

Charusmita S.G. and P. Ajithprasad: A Preliminary Study of Stone Implements from Gola Dhoro an Indus Civilization Site in Gujarat.

Shahida Ansari: Ethnoarchaeological Studies among the Mahadeo Kolis of Maharashtra.

P. Binodini Devi: Thongjao Pottery: An Ethnoarchaeological Study.

V.D. Misra, J.N. Pal and M.C. Gupta: Chronology of the Neolithic Culture of Vindhyas.

A.K. Prasad: Prehistoric Rock Paintings of South Bihar – Some Observations and Comparisons with Other Rock Art Regions.

Shipra R. Upadhyaya: Selected Rock Paintings from Raichur: Some Steps beyond the Basic Analysis.

A. Sundara: Rock Engravings from Sonde and Gavati and Vrishalsarga Ritual.

Vijay Sathe: A Rare Example of Dental Pathology in the Elephant of Lower Pleistocene.

Shehnaj Husne Jahan: Bengal's Contribution to the Indian Ocean Trade of the Early Historic Period.

Shilpa Gore: The Unusal Featurous Temple at Ratanwadi.

P.P. Dandawate and B.S. Gajul: Koppeshwar Temple, Khidrapur: Architectural and Iconographical Perspective.

Jaya Jose: Re-examining the Greco-Roman Aspects of Some Composite Motifs in Early Indian Art.

Shreekant P. Ganvir: The Vihara Cave at Banoti.

Bratiti Sen: Nandadirghi-Vihara of an Army Chief Vajradeva at Jagajjivanpur, Maldaha District, West Bengal.

Pranab Jyoti Sharma: Archaeological Investigations at Numoligarh: A Medieval Fort in the Dhanasiri Valley of Assam.

R.P. Pandey: Palaeoenvironment and Rise of Cultures in Northern Madhya Pradesh, India.

Sheila Mishra, Sonali Naik and Sushama Deo: Early Holocene Archaeological Sites in the Godavari Valley.

Santosh Kumar Singh: Beginnings of Urbanization in Middle Ganga Plain: Technological and Ecological Perspective.

Vasant Shinde: Protohistoric Research and Evidence of Development of Village Life in Mewar, Rajasthan.

Nupur Dasgupta: Settlement Patterns in Early History: Technological and Ecological Perspective.

Suman H. Pandya: Mesolithic Settlements in Sabarkantha: Beginning of Agriculture.

P.C.Venktasubbaiah: Beginning and Development of Agriculture in the Rayalseema Region of Andhra Pradesh: An Archaeological Perspective.

P.K. Thomas and Arati Deshpande-Mukherjee: Preliminary Observations on Animal Exploitation at Mahurjhari. A Megalithic Site in Vidarbha, Maharashtra.

P.P. Joglekar: Societal Attitudes of the Pre-Industrial Societies towards their Domestic Animals: A Case Study of the Donkey in Ancient India.

Veena Mushrif: Preliminary Observations on Human Skeletal Remains from the Dokhma at Sanjan: A Early Medieval Site.

Yogambar Singh Farswan: Reconstruction of Palaeodiet through the estimation of trace elements and isotopic ratios of carbon in the faunal remains from Mid-Central Garhwal Himalaya.

S.B. Ota: Salvage Archaeology: A case Study in Narmada Dam Project.

T. Satyamurty: Recent Excavations at Adichanellur.

A.K. Kanungo: Collection of Naga Antiquities: Was it Looting?

Kurush Dalal: Religion and Archaeology: Examinations at Sanjan (2002-04).

Rhea Mitra: Glass Artefacts from Sanjan. A Preliminary Study.

N. Taher and Abhijit: Documentary Film on Mystery of Queen Kelevan: The search Continues.

Life Members

The following persons joined the family of life members of the Society during 2005-2006:

Shri Milan Kumar Chauley, Shri Arun Kumar, Ms. Anjana Reddy, Shri J. Manuel, Shri Pranab Jyoti Sharma, Shri Shrikant P. Ganvir, Ms. Shipra R. Upadhyay, Shri Sayan Bhattacharya, S. Aarumugam, Dr. H. Chandrasekhar, Shri Sangharsha Rao, Shri Lee Hmaji, Dr. M.D. Sampath, Ms. Mandakini Sharma, Shri K.K. Bagai, Shri Tulsiram Naik, Dr. Pradeep Meshram, Dr. L.S. Rao, Shri Arun Rai, Shri C.B. Patil, Shri Vimal Tiwari, Shri Jayashankar Naik, Ms. Sunita Tewatia, Shri A. K. Sinha, Dr. Peeyooshkant Sharma, Shri Abhay Deshpande and Dr. Ramakant.

We record with deep regret that during this year one of our life members Dr. Gudrun Corvinus, a distinguished scholar passed away.

Meeting of the Executive Committee

Minutes of the Meeting of the Executive Committee

A meeting of the Executive Committee of the Society was held at Jnana Jyothi Auditorium, Central College Campus, Bangalore, at 13.30 hrs on 17th December 2005. The meeting was presided over by the Chairman Prof. V.N. Misra. The following members were present.

1. Prof. V.N. Misra, 2. Dr. S.P. Gupta, 3. Dr. M.C. Gupta, 4. Dr. Alok Kanungo 5. Dr. P.K. Thomas, 6. Dr. P.P. Joglekar, 7. Dr. P.S. Joshi, 8. Dr. Arati Deshpande-Mukherjee, 9 Dr. Savita Ghate, 10. Dr. S.G. Deo and 11. Dr. Shanti Pappu.

Dr. R.C. Agrawal, Dr. K. Krishnan, Dr. Ajitprasad, Dr. B.C. Deotare, Dr. K. Ismail, Dr. V.D. Gogte, Dr. Rakesh Tewari, Dr. A.S. Gaur and Dr. Selvakumar were unable to attend the meeting.

At the outset, the General Secretary, Dr. P.K. Thomas, welcomed the members. He apprised the Committee about the major activities of the Society during 2004-2005. These include details of the 32nd Annual Conference held at Ganna Sansthan Auditorium Dalibagh, Lucknow organised by the Directorate of Archaeology, Government of Uttar Pradesh and the Folk and Tribal Arts and Culture Society on 28-31st December 2004, and the publication of Vol. XXIX(1 & 2) of *Man and Environment.* He also apprised the Committee of the details of the audited statement of Society's income and expenditure during 2004-2005, which is printed in Man and Environment XXX(2). The Society's financial situation remains reasonably good.

The resignation letter submitted by Dr. P.S. Joshi, Assistant Secretary, due to his non-availability in Pune has been accepted by the Executive Committee. The members of the Executive Committee appreciated the valuable contribution made by Dr. Joshi to the Society. It was decided that Dr. P.P. Joglekar, Joint Secretary would take over the duties of Dr. Joshi till end of the financial year.

Looking at the increasing cost of printing, postage, etc. Executive Committee has resolved to raise the Life membership subscription of Rs. 2000 to 3000 for South

Asian members and from US dollar 300 to 400 for foreign members.

It has been decided to write to all ASI Circle offices requesting them to order for Society's publications (*Man and Environment* and Monographs).

Launching the web site of the Society has been entrusted to Mr. Arun Sinha and Dr. V. Selvakumar.

Meeting ended with a vote of thanks to the Chair.

Meeting of the General Body of the Society

The General Body meeting of the Society was held at Jnana Jyothi Auditorium, Central College Campus, Bangalore, at 17.00 hrs on 17th December 2005. The meeting was presided over by the Chairman Prof. V.N. Misra. The following members were present.

S.R. Adhyapak, Kumar Akhilesh, Shahida Ansari, Arati Deshpande-Mukherjee, Kurush Dalal, Rhea Mitra Dalal, A. Dandekar, P.P. Dandwate, Hemant Dave, Sushma Deo, P. Binodini Devi, K.N. Dikshit, S. P. Ganvir, Savita Ghate, S.S. Gore, M.C. Gupta, S.P. Gupta, S.S. Jadhav, Shehnaj Husne Jahan, P.P. Joglekar, P.S. Joshi, P.M. Kabragode, M.D. Kajale, Alok Kanungo, Giriraj Kumar, Manoj Kumar, Sheila Mishra, V.D. Misra, V.N. Misra, R.K. Mohanty, Malti Nagar, Rukshana Nanji, S.B. Ota, J.N. Pal, R.P. Pandey, S. Pandya, Shanti Pappu, Sadasiba Pradhan, A.K. Prasad, K. Rajan, P. Rajendran, Anjana Reddy, Vijay Sathe, V. Selvakumar, R.K. Sharma, M.L. Sharma, Pranab J. Sharma, V.S. Shinde, A.K. Singh, Chanchala Srivastava, Rakesh K. Srivastava, J.P. Srivastava, V.H. Sonawane, A. Sundara, N. Taher, P.K. Thomas and Shipra R. Upadhyaya.

The following business was transacted at the meeting.

Dr. P.K. Thomas, General Secretary of the Society, presented the report of the activities of the Society for the year 2004-2005. The members of the Society unanimously approved it.

The General Secretary placed the Annual Audited Statement of the Accounts for the year 2004-2005 before the General Body, and the members present unanimously approved it.

President of the Society for 2006

Dr. P.K. Thomas proposed the name of Prof. (Retd.) V.D. Misra, Dept. of Ancient History and Archaeology, Allahabad University, as President of the Society for the next year. The proposal was unanimously accepted by the members present.

Professor H.D. Sankalia Memorial Lecturer for 2006

Dr. S.P. Gupta proposed the name of Dr. (Mrs.) Shobhana Gokhale, Retired Reader, Dept. of Archaeology, Deccan College Post-Graduate and Research Institute, Pune for the Prof. H.D. Sankalia Memorial Lecturer for 2006. The members present unanimously approved the proposal.

The 3rd Professor R.K. Sharma Award for Excellence in Archaeology

In recognition of the valuable contribution made by Dr. S.P. Gupta to Indian Archaeology, over a period spanning more than fifty years, the third Professor R.K. Sharma Award for Excellence in Archaeology was conferred upon Dr. S.P. Gupta at the conference venue in Bangalore.

The meeting ended with a vote of thanks to the Chair.

16-09-2006

P.K. Thomas
General Secretary

INDIAN SOCIETY FOR PREHISTORIC AND QUATERNARY STUDIES

c/o Department of Archaeology, Deccan College, Pune 411 006

BALANCE SHEET AS ON 31st MARCH 2006

Funds and Liabilities	Rs.	Rs.	Properties and Assets	Rs.	Rs.
Trust Funds or corpus Bal. as per prev. B/S	656,108.52		Immovable Properties (Fixed Assets)	102,145.49	
Ajustment during the year			Add: During the year	00.00	
(Donations recd during the year)	00.00	656,108.52	Less: Sold during the year	00.00	
			Less: Depreciation @ 5%	21,773.24	
(Created under the provisions of the trust			(As per Schedule)		80,372.25
deed or scheme or out of the income)					
Depreciation fund	00.00		Investments (As per Schedule II)		1,843,683.44
Sinking fund	00.00				
Reserve fund	1,216,456.26		Other Movable Properties		00.00
Add: Surplus of Income & Expenditure A/c	00.00		Bal. as per prev. B/S.	00.00	
Other Earmarked Funds	83,607.95	1,300,064.21	Add: During the year	00.00	
			Less: Sold during the year	00.00	
Loans (Secured/Unsecured)			Less: Depreciation @ 5%	00.00	
(As per schedule)					
For expenses	00.00		Loans (Secured and Unsecured)	00.00	
For Advance	00.00		Loans Scholarships	00.00	
For rent and other deposits	00.00		Other Loans and Advances	6,736.87	
Audit fee Provision for	2,360.00				
Amount Payable	00.00		Cash & Bank Balance		
Other liabilities	788.94	3,148.94	Cash	6,399.77	
			Bank Balances	87,967.97	
Income & Expenditure A/c.					101,104.61
Bal. as per prev B/S	00.00				
Less: Appropriation if any	00.00		Income & Expenditure A/c.		
Add: Surplus of Inc& Exp A/c.	65,838.63		Bal. as per prev. B/S	00.00	
Less: Transfer to General Reserves	00.00	65,838.63	Add: Deficit for the year	00.00	00.00
Total Rs.		2,025,160.30	Toral Rs.		2,025,160.30

As our report of even date

FOR A.S. CHANDVANKER & CO., CHARTERED ACCOUNTANTS

Date: 07.08 2006
Place: PUNE

A.S. CHANDVANKER (Proprietor)

(P.K. Thomas)
GENERAL SECRETARY

(P.P. Joglekar)
JOINT SECRETARY

(Arti Deshpande-Mukherjee)
TREASURER

INDIAN SOCIETY FOR PREHISTORIC AND QUATERNARY STUDIES,

c/o Department of Archaeology, Deccan College, Pune.

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31st MARCH 2006

Expenditure	Rs.	Rs.	Income	Rs.	Rs.
To Expenditure in respect of			By Rent* (Accrued/Realised)		00.00
Properties	00.00				
Rent, Taxes, Cases	00.00		By Interest* (accrued/realised)		
Repairs and Maintance	00.00		On Securities	00.00	
Salaries	00.00	00.00	On Deposits (FD)	74,820.00	
			On Loan	00.00	
To Expenses on the object of the trust			On Bank Account	1,800.00	76,620.00
(As per Schedule A)					
Conference Expenses	84,554.13		By Donation in cash or kind		00.00
Publication Expenses	172,578.00				
Other Expenses	24,826.24	281,958.37	By Conference Grant		00.00
To Audit fees		00.00	By Publication Grant – ICHR		63,000.00
To Contribution and Fees		00.00	By Cost of Monographs – DHP etc.		7,632.00
To Depreciation		00.00	By Life Membership Fees		54,000.00
To Amount transferred to reserve or specific fund		00.00	By Sale of Man & Environment Volumes		146,545.00
To Surplus carried over to B/S		65,838.63	By Transfer from Reserve		00.00
			By Deficit carried over to B/S		00.00
Total Rs.		347,797.00	Total Rs.		347,797.00

As our report of even date

FOR A.S. CHANDVANKER & CO., CHARTERED ACCOUNTANTS

Date: 31.08.2005
Place. PUNE

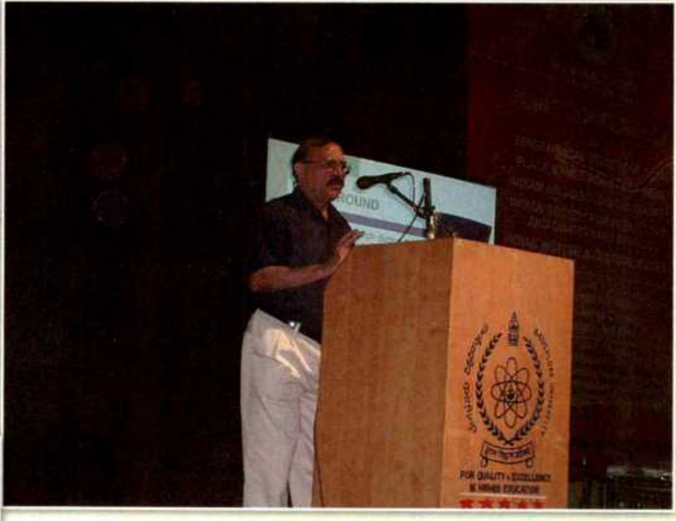
A.S CHANDVANKER (Proprietor)

(P.K. Thomas)
GENERAL SECRETARY

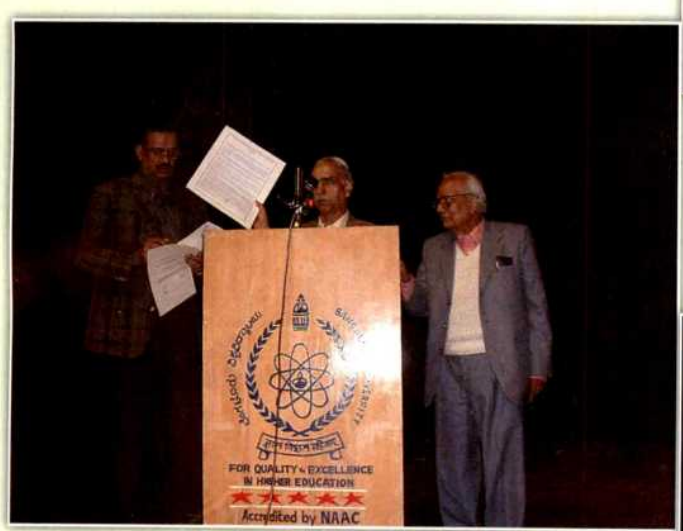
(P.P. Joglekar)
JOINT SECRETARY

(Arti Deshpande-Mukherjee)
TREASURER

Inauguration by H.H. Sri Sri Ravi Shankar



Prof. M.L.K. Murty delivering the Presidential address



Dr. P.K. Thomas, Prof. V.N. Misra and Dr. S.P. Gupta on stage

Dr. S.P. Gupta addresses the audience

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